THE
ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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PUBLICITY.

THE activity of the gas interests in devising methods for business getting should stimulate the commercial management of electricity supply companies, which is far from perfect. They leave no stone unturned to effect their object, and their latest move was to hold a meeting on Thursday, 12th inst., to inaugurate the "British Commercial Gas Association."

The gas interests desire not only to extend their business, but to preserve that which they have—both very difficult to achieve in the face of the formidable competition of electricity. The contest between the two systems is so unequal, owing to the great superiority of the electric current for lighting and power, that it is purely a question of good commercial management as to the rapidity with which the change over will be accomplished.

There will always be a certain percentage of the residents and manufacturers who will lag behind the rest in making changes; this is due to special circumstances. Occupants of houses under short terms of tenancy decline to go to the expense of wiring and fitting their premises; the innate conservatism of others, who lose all the benefits of improved conditions, and the cost in factories of scrapping the obsolete machinery—these are the conditions favouring the systems in possession. But the ultimate result is a foregone conclusion; in fact, as one of our contemporaries has put it, the weapons in competition are like a magazine rifle against a muzzle loader.

Meanwhile, it is essentially important that the commercial management of electricity supply companies should be thoroughly efficient and under the control of business, as distinguished from technical, men, whose attention must be concentrated upon the important work of securing new and profitable consumers of energy.

The programme of the British Commercial Gas Association covers most of the ordinary methods of pushing business known by the generic term "Publicity"—such as the use of the newspaper press for direct and indirect advertising—the education of the public by exhibitions, lectures, publications, and canvassing.

The organisation is based upon a comprehensive publicity and propagandist system, supported by the gas interests throughout the country, with ample capital provided by the companies. A map published in the *Journal of Gas Lighting* shows the amounts already subscribed, the United Kingdom being divided into areas, and the present contributors in each division shown by dots. The amount subscribed up to October 17th was £10,635, a sum far below the estimated requirements of the new Association, which

Mr. H. J. Yates, chairman of the Society of British Gas Industries, considers ought to be £25,000 to start with.

Is it not time that the electricity supply industry took a leaf out of their competitors' book, and by a vigorous effort dealt with the "Publicity" or "Business-getting" organisations in a much more satisfactory manner than at present?

The suggestion of the promoters of the new Gas Association is the formation of a Committee consisting of district representatives, in order, by interchange of information, to pool the local experience for the benefit of all the members of the Association.

The electrical industry, like that of the gas suppliers, is divided between private companies and the municipal authorities, with the complication of several Town Councils undertaking both the gas and electricity supply in competition with each other.

For the whole electrical industry to be combined in one great organisation such as the gas people propose would be unnecessary and impracticable, but there is no reason why companies and Corporations should not form these business-getting associations in districts, or by the combination of suppliers dealing with similar classes of consumers.

The leading spirit in organising and managing the commercial business should be selected from those who have had the longest and widest experience in connection with the development of the industry.

Hitherto too much has been imposed upon the local managing engineer in leaving to him business-getting details in addition to the efficient and economical working of the plant for the generation and distribution of the current, as well as the thousand and one technical details connected with the supply and attending to the individual wants of the consumers.

In dealing with this important matter it is not a mere question of appointing canvassers to knock at people's doors and ask if they will change their old lamps for new, or to imitate Sam Slick's system of selling his clocks, nor will the business be procured by the issue of trade circulars, numerous leaflets and *ex parte* statements alone, though these methods are all good in their way.

It has been well said that *a satisfied consumer is the best canvasser*, and where the publications issued to residents on the line of mains contain testimonials from their neighbours, giving their experience of the new system of light, heat and power, more satisfactory results are produced than by any other mode of persuasion.

One reason put forward for establishing the British Commercial Gas Association is "to meet the current of vituperative misrepresentation which the industry was called upon to meet." This is a roundabout way of alluding to the unpalatable facts with which they have to deal in the comparison between electricity and gas as to their relative merits. "Vituperative misrepresentation" indeed! —Surely a strange charge to come from such a quarter!

The many advantages of electricity have to be impressed upon those who have never experienced them, and there is no more efficient way of accomplishing this result than by publishing locally the experience of the users.

The British Commercial Gas Association appears to contemplate an extensive system of advertising in the local Press, and the chairman pointed out that "he knew what £10,000 meant in advertising—it would not go very far."

Now, what is of still greater importance is to secure the interest of the Press in every locality, by giving it the opportunity of testing the merits of the claims made by the competing systems, especially in relation to the public lighting of the towns, which concerns every resident. The Press is always ready to publish such facts as it can verify for the general information of its readers. It is of great importance that in all publicity arrangements the fullest use of the channels of information offered by the local newspaper should be made.

Imperial Cables.

The Imperial Cable position was discussed at some length by a correspondent in the *Morning Post* of October 12th. We learn from him that the object of the Imperial Press Conference of 1909 was to bring about a reduction of rates across the Atlantic, but after the lapse of almost three years its attainment appears as remote as ever, and Canada in the interim has seceded from the agitation for an Atlantic cable, and is still awaiting the results of efforts made by the British Government.

The small reduction of the Press rate made by the Pacific Cable Board has been of no use to Canada and South Africa, but has resulted in inducing Press cables, described as often grotesquely parodying British and European news, from the Pacific Coast of America at 3d. per word, as against 9d. per word from London. Setting aside the injury to Imperial solidarity, speedy business and social intercommunication, the effect of dear Press cables is to enforce a starved Imperial service to and from the overseas Dominions, prevent the passage of great speeches and comment on Imperial affairs, and substitute a record of sport and catastrophe upon which the Press depends; and, finally, Canada and Australia rely very largely on the United States Press agencies. We gather from the rest of the article that reforms are required as follows:—(1) a guarantee against injurious monopolies obtaining control of cable companies and preventing free competition; (2) a Press rate for ordinary news as cheap as traffic warrants; (3) a special rate for Imperial news—*i.e.*, reports of Parliaments, of political speeches and statements, of political Press comments—the rate for these to fall below the remunerative level to encourage their transmission. An effective remedy for the evils, the correspondent further states, is a system of either State-owned or State-controlled cables, the arteries of Imperial life to be under Government guardianship; and then he discusses questions as to absolute or company ownership under control, and the subsidising of overseas newspapers to print more cables, concluding with the statement that it would be a startlingly unexpected development if a public department were found fit for doing journalistic work requiring the highest skill.

Dealing with these points in order: (1) A guarantee against monopolies, in view of the process of handing over to foreign management all the British cables now being carried out, cannot be made, competition is materially lessened, and inadequate measures for control have been taken. (2) The control of rates is now practically in the United States, and it will naturally be used by and for themselves. (3) There will be no need for the foreign managers to pose as British Imperialists, as they have command of all the traffic, and will not fill the cables unless they choose. Finally, we think it is quite time that the Empire Press Union should fully recognise that the only way to secure control of anything is by complete ownership, and that this object must be continuously worked for.

The *Colonial Office Journal* of October also contains an article dealing with this subject. It states that there is a sore of logic in the idea that the Government service should be carried out from end to end, especially if the Atlantic cables come under American control. At a second general meeting of the Anglo Co. on October 16th the lease was ratified, and this settles this question.

The journal, however, rather weakens its position by stating that as all the foreign companies are interested in the collection of traffic for the Pacific line, this would be adversely affected if the Governments invaded the Atlantic field by

putting down a line of their own, and the amount of business the Pacific cable would secure would be small, unremunerative and difficult to collect in Canada and the United States, in the face of the strong combination between the cable and landline organisations. We join issue with these conclusions. The foreign companies would remain allies for the simple reason that if they did not collect for the Pacific cable in Europe they would lose Australasian traffic entirely, and if they sent Canadian and American traffic *via* Europe, it would be surcharged 1s. per word more. With regard to the amount of support which could be obtained for an Atlantic cable—all the present ones being pretty well employed—and the absence of collecting offices and other facilities, these questions would best be left to a business man, who would be as likely to make the undertaking remunerative as a private company.

The West India Committee's circular of October 10th states that their secretary has been assured by Mr. Borden that the Dominion Government appreciates the importance of adequate telegraphic facilities between Canada and the West Indies. Perhaps some day the improvement agitated for so long may come about.

Co-Partnership and Labour Unrest.

We have been favoured with an advance copy of a "pronouncement" signed by some of the leading employers of labour and others who are authorities on industrial economics. The pronouncement is by way of an appeal to all who are connected with the nation's industry, either as workers or employers, for the recognition of the principle of co-partnership. The signatories point out that a system which divides those who are engaged in the necessary work of producing wealth into two armies, usually in a state of armed neutrality towards one another, can never be satisfactory.

In its simplest form, co-partnership of labour and capital involves (quoting from the circular) :—

"1. That the worker should receive, in addition to the standard wages of the trade, some share in the final profit of the business or the economy of production.

"2. That the worker should accumulate his share of profit, or part thereof, in the capital of the business employing him, thus gaining the ordinary rights and responsibilities of a shareholder.

"Co-partnership assumes a standard wage before there can be any talk of profit to divide.

"A standard wage assumes organisation to maintain it and to raise it. It assumes reasonable forms of trade unionism, collective bargaining, and the meeting of capital and labour upon equal terms. Organisation of both employers and employed, with conciliation machinery to fall back upon when outstanding differences remain, we regard as necessary in the interests alike of labour, capital and the community as a whole."

It is not, however, considered that such organisation is sufficient in itself, as the conflict of interest still remains too acute. A narrow-minded employer might still believe that every gain to labour is filched from his profits, and the workman on his part might be equally imbued with the idea that every improvement in profit is filched from his wages. It is essential to introduce some measure of unmistakeable common interest, and this is to some extent met by the provision of benefits for old age, which may either take the form of a lump sum payment or the payment of a weekly sum.

There are already in existence a large number of works carried out on co-partnership principles, the most successful being those connected with the gas industry. It is some 21 years since the system was first adopted by the South Metropolitan Gas Co., and the success of the system induced other companies to follow their example, with the result that at the present time the workers in the three London gas companies have accumulated nearly £600,000 capital in the works in which they are employed. Furthermore, the co-partnership undertakings now control more than half the capital which is invested in the gas companies in England. It is worth while to consider whether or not the successful results which have followed the adoption of the co-partnership principle in the production and distribution of gas could not be equally secured in the production and distribution of electricity. There is no obvious reason why they should not.

Whilst agreeing generally with the views set out in the memorandum, we consider that the greatest hindrance at present to the development of the co-partnership principle in manufacturing industries is the antagonistic attitude maintained by the officials of the large Trade Unions towards it. Many of them have bitterly opposed every attempt to introduce co-partnership methods into existing works, and the hostile criticism of the Furness scheme, which was given a trial by the men against the wishes of their leaders, is still fresh in the minds of our readers and of the public.

The Johannesburg Failure.

Elsewhere in this issue we give a full account, derived from an authoritative source, of the circumstances which led up to the erection of a gas-driven power station at Johannesburg, and the disastrous fate of that unfortunate installation. As our readers will remember, the contractors, after a period of strenuous efforts to complete the plant and to fulfil their obligations, finally abandoned the attempt in 1906; the usual litigation followed, and has dragged its weary length through the past five years, ending a few weeks ago in a judgment entirely favourable to the Corporation of Johannesburg.

We cannot recall a parallel to this remarkable episode in the whole history of power station engineering. The financial interests at stake were of the first magnitude; the scheme was conceived in a spirit of bold but confident enterprise, and failed only in respect of the power station; and there can be little doubt that had it proved successful, the employment of the large gas engine fed with producer gas for the generation of electrical energy would have received an immense impetus—whereas in fact it undoubtedly sustained a crushing blow.

It is difficult in so involved a problem to single out any one feature to which can be attributed the failure of the scheme. It must be granted that accident played a large part in the succession of reverses met with by the contractors, such as the death of their expert, the loss of part of the plant by shipwreck, the explosion in one of the blowers, and so on. Mature consideration of the circumstances, however, has led us to the conclusion that the fundamental and all-pervading factor to which was due the inevitable result was simply lack of experience.

It is a fact well known to those who have "gone through the mill" that the purchase of a licence, together with drawings and specifications, by no means conveys to the licensees the accumulated knowledge and experience of the original inventors. Of this fact we have seen not a few notorious examples of late years, in connection with the manufacture of steam turbines, and of large gas engines to Continental designs, and several engineering firms have burnt their fingers more or less severely. In the present instance the use of producer gas on an enormous scale was a practically untried feature; at the time of the execution of the contract, we believe there was not a single installation in Europe of large gas engines fed solely by producer gas. Hence, just as the earlier blast-furnace gas plants suffered from troubles due to the lack of any cleaning plant at all, so the Johannesburg gas engines suffered from the inadequate provision of cleaning plant to deal with the exceptionally tarry gas supplied by the producers; and when the cleaning plant was provided, it suffered from defects which were never rectified sufficiently to enable the plant to run with satisfaction.

The root of the trouble, both in the administration of this large contract under unique conditions as regards the remote situation and inaccessibility of the installation, and in its execution under equally unique conditions connected with its technical features, was lack of experience. It was too big a departure from the known and beaten track. We have no doubt whatever that, given sufficient time and money, the undertaking could have been brought to a successful issue, and it was most unfortunate that circumstances prevented the attainment of that result.

THE ELECTRICAL AND GENERAL ENGINEERING EXHIBITS AT THE TURIN EXHIBITION.

[BY OUR SPECIAL COMMISSIONER.]

In view of the importance of bringing it about that British engineering exhibits should on future occasions be better than was the case at Turin, a brief recital of the facilities offered by the Board of Trade to exhibitors at this Exhibition

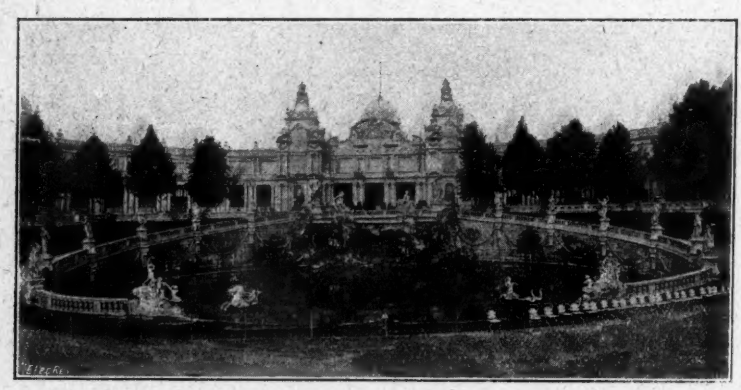


Photo. by [Argent Archer.

Turin Exhibition: Exterior of British Section.

will indicate how valuable they are, and how little real trouble is occasioned to exhibitors. These facilities were widely recognised by other than the engineering industries, whose displays evoked universal praise and admiration. The activities of the Board of Trade in organising the Exhibition commenced with a circular about the Exhibition in general and the commanding site secured for the British Section. The Board then proceeded to set out arrangements as to—

1. *Transport Facilities.*—While full rates were charged on the outward journey, the return journey is free of charge. Special lines were laid down connecting the railway stations with the Exhibition. Substantial rebates were secured from the steamship companies.

2. *Customs Formalities.*—Exhibitors' goods were transmitted in bond to the Exhibition. No duties are levied on goods re-exported at the close of the Exhibition.

3. *Installation of Exhibits.*— The handling of exhibitors' goods within the Exhibition was undertaken without further charge beyond that made for space occupied, such services including taking delivery of packages at the Exhibition, unloading and placing on the space or stand allotted, removal, storage and return of empty packing case, and reloading at the close of the exhibition.

4. *Show Cases and Stands.*—The charge made for space allotted covered show cases, platforms and railings, and the fixing, free of charge, of exhibitors' names on the upper panels of showcases. Internal fittings were supplied by the exhibitors themselves. As uniformity in this respect was desirable, approval of these was insisted on, but exhibitors were able to purchase materials to certain standard patterns at cost price.

5. *Motive Power, Lighting and Water Supply.*—In order to make the display as effective as possible, the Royal Commission made arrangements for the supply of gas, steam and electricity when used for showing machinery producing finished articles or illustrating manufacturing processes, at the special reduced prices of gas at 2s. 6d. per 1,000 cb. ft., electricity at 2d. per unit, and steam at 176 lb. pressure superheated to 280° C. at the boilers at 3½d. per 100 lb. For lighting purposes gas was charged at 3s. 6d. per 1,000 cb. ft., and electricity at 4d. per unit.

So much for the special facilities, which so many British engineering firms disregarded. The British Section had the great merit of having practically its entire exhibit concentrated at one place. The situation was fairly central, and the position a commanding one. A quadrant frontage, some 500 ft. in length, surmounted by a large central dome and flanked at each end by smaller domes, gave access to the 220,000 sq. ft. given to the British Section. This, and the interior of the British Pavilion, are illustrated herewith.

The supply of light and power to the British Section was effected by D.C. generators belt-driven from internal combustion engines. The gas producers were placed outside the Machinery Hall of the British Section.

Power Plant.—The duties of supplying power to the British Section were divided between Messrs. Richard Hornsby & Sons, Ltd., of Grantham, and Messrs. The Campbell Gas Engine Co., Ltd., of Halifax. Each firm had its own installation of suction gas producers situated on some vacant ground immediately at the back of the section. The Campbell Gas Engine Co.'s equipment includeed one horizontal suction gas engine rated at 120 B.H.P. (maximum) running at 160 R.P.M., driving an 80-KW. Phœnix dynamo through a laminated leather belt. The engine is throttle-governed. The other set supplying light and power to the section consisted of a four-cylinder vertical engine rated at 150 B.H.P. (maximum) running at 300 R.P.M., direct-coupled to a 100-KW. Phœnix dynamo. This type of engine has been specially designed for small station work. Forced lubrication is employed for the main bearings.

A small but useful starting set is shown, comprising a Campbell 4½-B.H.P. lampless oil engine direct coupled to an air compressor which delivers air at 200 lb. per sq. in. into a steel receiver. Each engine, of course, has its air starting valve.

Photo. by [Argent Archer.

Interior of Machinery Hall, in the British Section.

There was also exhibited a larger four-cylinder (290 B.H.P.) vertical engine similar to the 150-B.H.P. engine.

The suction gas producers for these engines are of the Campbell Gas Engine Co.'s latest type, and are specially designed for working with inferior fuel such as anthracite peas or coke breeze. The producer is arranged so that the ashes and clinker can be removed at any time during the production of gas without stopping the engine. The hearth is entirely open, so that the condition of the fire can be inspected without any trouble.

Messrs. Hornsby & Sons' installation comprised two horizontal 100-H.P. suction gas engines running at

230 R.P.M., and driving Lancashire Dynamo and Motor Co.'s generators. These engines govern partly by variation of the quantity of the charge and partly by variation of the quality. The makers claim for this a high efficiency at light loads. Compressed-air for starting from a receiver is installed, the air compressor which charges the receiver being driven by a small petrol engine. Messrs. Hornsby's producers are designed for working on anthracite, coke or charcoal. The fire-grate has its bars so arranged that they can be rocked to and fro to free the fire from clinker.

The control of the generators and distribution to the various circuits is effected by Messrs. Reyrolle & Co.'s main switchboard, illustrated in our issue of October 6th.

The board consists of 10 panels in all, comprising five generator panels, two power distribution panels, and three lighting distribution panels.

Panels Nos. 1 to 5 control 150-KW., 75-KW., 75-KW., 60-KW., and 60-KW. generators respectively, No. 1 panel being fitted with 800-ampere circuit-breakers and fuses, and the remaining four with 400-ampere circuit-breakers and fuses. The equalising switch is of the same capacity, and voltmeter, ammeter, shunt breaking switch, and shunt rheostat handwheel are also fitted.

One of the power panels is fitted with two 500-ampere circuit-breakers, one double-pole 500-ampere fuse, and an ammeter reading to 600 amperes, and the lower half of this panel is devoted to a recording voltmeter and recording ammeter. The other power panel is similarly equipped except that the lower half is devoted to four 50-ampere lighting circuits, double-pole switches and fuses being provided.

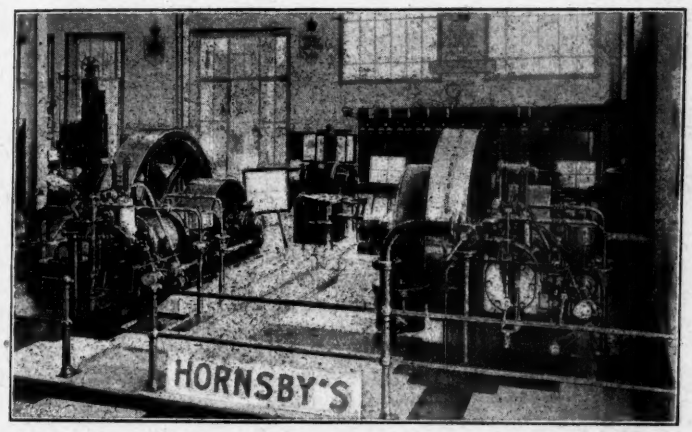


Photo. by] [Argent Archer.

Electric Generating Plant in the British Section.

One of the lighting panels is fitted with an overload 800-ampere D.P. circuit-breaker, with ammeter and D.P. switch of similar capacity. Another of the lighting panels is similarly equipped, and the third has fuses in place of circuit-breakers and a ground detector in place of the ammeters. The lower portion of each of the lighting panels is equipped with switches and fuses for four D.P. circuits.

An illuminated voltmeter on a swing frame is fixed at one end of the board for paralleling, and illuminating lamps are spaced along the top at regular intervals. The connections at the back are made by means of copper strips of very ample section, and on every part of the board all joints which carry current are carefully scraped to fit.

The board is surmounted by a handsome wrought-iron scroll carrying a large eight-day clock and name-plate.

Beside the switchboard platform, Messrs. A. Reyrolle and Co. are also exhibiting a handsome swing frame containing 24 large photographs of their works and their leading manufactures.

From the point of view of the visitor to the Exhibition, it was, perhaps, regrettable that the switchboard was placed against an end wall of the building at right-angles to the path followed by visitors. It would have been more striking if space considerations had permitted its directly facing the spectator.

On the general engineering side, mention must be made of internal combustion engines of various sizes and types. Messrs. Blackstone & Co., Ltd., showed a 25-H.P. stationary engine for working on crude oil, and smaller engines requiring refined petroleum. The National Gas Engine Co., of Ashton-under-Lyne, exhibited a 36-H.P. suction gas engine with its producer, and four oil engines ranging in horse-power from 3 to 22.

Agricultural engines were in strong evidence with handsome exhibition finish. The leading makers, such as Messrs. Clayton & Shuttleworth, Messrs. Marshall, Sons & Co., Messrs. J. & H. McLaren, and Messrs. Ruston, Proctor and Co., Ltd., sent characteristic types.

In regard to the auxiliary features of power station supply, many familiar items were in evidence—such as Messrs. E. Green & Son's economiser, and Holden & Brooke's injectors, steam traps, feed water-heaters, centrifugal pumps and liquid meters for various fluids. Boiler and steam pipe coverings were shown by Messrs. Wm. Kenyon & Sons, Ltd. Messrs. Reavell & Co. showed several of their patent air compressors, one in operation, pneumatic hoists, and high-speed steam and oil engines, the steam engine being in operation. The Underfeed Stoker Co., Ltd., displayed a duplicate of the mechanical stoker which was in operation under the Tosi boilers in the Exhibition main generating station.

In regard to machine tools, special mention must be made of the excellent displays by Messrs. Alfred Herbert, Ltd., and by Messrs. Hulse & Co. The former showed in operation a complete equipment of automatic and semi-automatic labour-saving machine tools, including screw-cutting machines and turret lathes. Drilling and milling machines were displayed as well as tool and cutter grinding machines, and also an automatic bevel-gear cutting machine. The latter exhibited a three-spindle motor-driven universal horizontal drilling, boring, tapping, studding, and milling machine, also a horizontal straight milling machine of the planer type, together with various other milling and shaping machines. These two stands were in every way creditable to British manufactures. Tools, tool steels and wood-working machines were also shown.

Returning to matters of a more immediately electrical nature, reference must be made to what can only be regarded as akin to a species of overflow from Olympia. Small in extent, and inferior to the home exhibition which has made large demands on our manufacturers, we can only regard the collection in Classes 28, 29 and 30 (respectively the generation and distribution of electricity, the mechanical application of electricity, and electric lighting), considered as a national example, as a pettifogging display. In saying this, one obviously excepts the round dozen of individual British firms exhibiting under these sections, to whom all credit is due for their courage. Naturally, there was nothing startling; small Crypto motors, Morganite and kindred brushes, Muirhead rectifiers and automatic transformer switches, Venner time switches, Westinghouse-Cooper Hewitt mercury rectifiers for D.C. flame arc lamp circuits, Nalder instruments, and Reason meters and demand indicators with measuring instruments and fuse boxes are familiar enough to us, and are likely to appeal to a small class of Exhibition patrons.

At every turn one felt disappointed and discouraged by the fewness of the electrical firms exhibiting. Individually, the small collection of British exhibits is of apparatus intrinsically good, and often very good. If British electrical firms, as a whole, are to secure a better footing on the Continent, it can only be by a concerted display organised by some central body and supported by the industry as a whole.

What can be done in scientific matters alone is well exemplified by two of the organised exhibits of the British Section, namely, the Chemical Laboratory and the Physical Laboratory. In the former is found all the equipment of a complete chemical laboratory fitted alike for the routine of works industrial practice, or for specialised research. It

was a splendid assertion of national capability and resource, and a justified declaration that Great Britain was able to challenge the supremacy of Teutonic manufacturers in this field. Compared with this, the scattered examples of chemical laboratory apparatus and reagents displayed by all other countries in the Turin Exhibition suggested rather the contrast between the universal provider selling miscellaneous commodities in a country village and his rival in a large city.

Yet of greater interest to our readers, and indicating the value of an organised exhibit, was the physical laboratory. Perhaps electro-physical would have been a better title, for most of the apparatus was of an electrical nature, and many instruments of a purely physical character were to be found in adjoining show cases. The special "Catalogue des Instruments Mathématiques et Scientifiques" issued by the Exhibitions Branch of the Board of Trade is well worth its small cost, and a permanent position on an engineer's book shelf. For the organisation of the laboratory itself we are indebted to Dr. Glazebrook and the National Physical Laboratory, and to two very strong committees for the organisation of the displays respectively of scientific and chemical instruments. Within the physical laboratory were to be found an Ayrton-Mather galvanometer by Baird & Tatlock; a Duddell oscillograph (with all accessories for use on a 50,000-volt circuit), a Callender pyrometer, and an Einthoven galvanometer by the Cambridge Scientific Instrument Co.; and an Irwin Oscillograph, by Robert W. Paul. Outside in show cases there was much deserving of mention, in the way of microscopes, spectroscopes, Weston cells, theodolites and pyrometers. Space alone prevents our dealing in detail with these.

Organised exhibits of industrial sections can be the only effective manner of doing justice to British potentialities. This was done in the case of the Bradford woollen industry, and in that of automobiles; surely it should not be beyond the range of British efforts to do the same for our electrical manufacturers when the next International Exhibition comes along.

JOHANNESBURG GAS PLANT.

In our issue of the 13th inst. we reported the judgment by Lord Ormidale in the action brought by the Johannesburg Council against Messrs. D. Stewart & Co. and Mr. William Beardmore. A considerable time has elapsed between the events leading up to this action and the judgment just announced, due in large measure to the intricacy of the case. It may be of interest to our readers to recall briefly the history of this matter.

About the middle of 1902, on the conclusion of the South African war, the Municipal Council of Johannesburg instructed a London firm of consulting engineers to report to them on the reorganisation of the electric lighting and power supply, and the electrification and extension of the tramways. The electric supply station then in existence had grown up gradually during a number of years and had become quite inadequate to the demands of the town, and still more so to the greatly increased demands which were anticipated due to the development which was expected to follow the conclusion of the war.

The consulting engineers visited Johannesburg at the end of 1902 and beginning of 1903, and presented a detailed report, recommending the establishment of a new generating station, supplying both lighting and tramways, with a distributing network in the town and suburbs for light and power, and a completely new tramway system, amounting to about 45 miles of track, and the removal of the old narrow-gauge horse tramway.

The choice of motive power for the generating station was discussed in the report, the comparative advantages of gas and steam plants being considered at some length. An important consideration in the comparison was the high cost of water in Johannesburg, amounting to 3s. 6d. per 1,000 gallons.

The coal available was all of a bituminous character. Those samples which were sent home and subjected to preliminary tests with a view to ascertaining its suitability for producer work, showed satisfactory results. The report showed that while the capital cost of a gas plant would be somewhat larger than that of a steam-driven plant, the total cost of energy, including capital charges, would be lower with the gas-driven plant, the adoption of which was recommended, subject to satisfactory bulk tests of the coal for gas-producer work, and subject also to unusually stringent guarantees.

It was afterwards found in actual practice that the cost of the coal was more than covered by the value of the tar recovered. This was used in large quantities by the municipality itself for spraying roads, and, when not produced by the power plant, had to be imported at a very high cost.

The report came in for a good deal of criticism. The energy required was said to be greatly over-estimated, and the estimated cost was declared to be too low. Similar criticisms were made on the tramway proposals. Subsequent experience, however, justified the estimated figures.

Early in 1903 the Council instructed the consulting engineers to proceed to carry out the recommendations contained in their report, and specifications were issued for various parts of the plant.

The specification for generating plant issued in September, 1903, invited alternative tenders for gas and for steam plant and for both classes of plant it aimed at obtaining definite results rather than defining details of design. Thus in the case of the gas-producer plant, it defined the quantity of coal to be gasified and required that the cleaning plant should be such that the resulting gas should contain not more than one ounce of dust in 20,000 cb. ft., while the tenderers were asked to state and guarantee the analysis of gas produced and the calorific value per cubic foot and per pound of coal gasified.

With regard to the producers and cleaning plant, the specification contained as a suggestion, a fully worked out general arrangement, particulars of the units required, also a good deal of detail regarding coal handling and other auxiliary plant. Similarly, with regard to the gas engines, detail of construction was left open, so as to make it possible for the various standard designs to be included in tenders by the respective makers, tenderers being required to state and guarantee the efficiencies obtainable under various conditions of load.

To meet the possibility of separate contractors being employed for the producer plant and the engine plant, the cleanness of gas required in the producer specification was defined as one of the conditions available in the engine specification. The electrical sections of the specification were on similar lines. In the case of all guaranteed data, a scale was defined imposing a deduction on the one hand for failure to fulfil the guarantees, and on the other hand giving a bonus for the attainment of results better than the guarantee. Corresponding conditions as to consumption were defined for the alternative tenders for steam plant.

For gas-producer plant, five different makers submitted tenders, and 12 different manufacturers tendered for gas engine plant with electrical machinery. Tenders for steam plant were received from 16 different firms. With regard to the latter, it is noteworthy that the tenderers for steam turbine plant contemplated driving only the alternators by turbines, the development of the direct-current generator for the speed required in turbine work not being at that date sufficiently advanced.

In the report on the tenders submitted by the consulting engineers and considered by the Municipal Council in March, 1904, the most advantageous tender for steam plant was shown to involve a capital expenditure of about £28,000 less than the most advantageous tender for gas plant, but the comparison of working expenses based on the tenderers' guaranteed consumption, with the liberal margin of 50 per cent. for actual working conditions, showed a difference in favour of the gas scheme of over £15,000 per annum.

During the period allowed for the preparation of tenders, Transvaal coal in considerable quantity had been placed at the disposal of tenderers and approved—a leading maker of gas producers described it as an ideal coal for gas production. The Council decided to accept the lowest tender, that of Messrs. Poetter & Co., of Dortmund, for gas-producer plant, to be manufactured in Great Britain to their designs, and of Messrs. Siemens Bros. & Co., Ltd., for electrical generating plant, with Oechelhauser gas engines manufactured by Messrs. D. Stewart & Co., Ltd., of Glasgow. Prof.

Unwin, to whom the matter had been referred for an independent opinion, concurred in the recommendation of the consulting engineers.

In the course of subsequent negotiations, it was arranged that Messrs. D. Stewart & Co. should themselves be main contractors for the whole plant, including producers, gas engines and electrical machinery, while Mr. William and Mr. Joseph Beardmore undertook to act as sureties for half the value of the contract, as required by the general conditions. Messrs. D. Stewart & Co., before agreeing to take over Messrs. Poetter & Co.'s tender, made close investigations as to the suitability of the plant included therein, availing themselves of the experience in gas plant of the firm of Messrs. William Beardmore & Co., with whom they were closely allied. The producer work was subsequently carried out by Messrs. Beardmore and Co. in their various works, in which they had numerous large producers in use making gas from bituminous coal not very unlike the Transvaal coal, this gas being used partly for steel making and partly for driving large gas engines of similar type to those included in the tender.

It was arranged that one producer, with cleaning plant, should be erected and tested in those works with Transvaal coal, of which a considerable quantity was brought over for that purpose.

In April, 1905, the first producer was erected at Messrs. Beardmore's works at Dalmuir, and tested both with Scotch and Transvaal coal. It was then found that the anticipations of the consulting engineers regarding the inadequacy of the cleaning plant was justified, and that further cleaning apparatus would be necessary. The consulting engineers had already insisted that provision should be made in the lay-out of the piping for the addition of cleaning fans, if necessary.

In the discussion of the type of fan to be adopted, it was asserted by the contractors that the fans manufactured by Messrs. Crossley Bros. could not be bought independently of their complete gas plant, but this statement was not borne out by the evidence. Finally, fans of the design of Mr. Liversedge with vertical shaft were adopted, but it was found on test that the contractors had greatly under-estimated the power required to drive them and there was great delay in getting new motors.

Meanwhile, during the latter half of 1905, shipment of material to Johannesburg had been proceeding and the erection had been taken in hand. At the very outset of the work at Johannesburg, the contractors suffered the serious loss of their erecting engineer, Mr. Sinclair, who, after having had charge of the designing in the Glasgow works, had gone out to represent them in Johannesburg. He died, after only a few days' illness, and there is little doubt that his loss contributed in no small degree to the unsatisfactory result of this contract. He was never adequately replaced. A minor mishap was the loss of a steamer carrying parts of several of the engines and producers, which, though of course replaced, involved vexatious delays and confusion.

In April, 1906, the first producers were fired, and in May the first of the gas engines was ready to run. The contractors' representative was now faced with a dilemma. The contract time for setting to work—October, 1905—had been long exceeded, the public were becoming impatient at the delay in working the electric tramways and the new light and power services, which had been completed. On the other hand, the delays in the provision of cleaning fans, which have been described above, involved the risk that, in starting up the plant, dirty gas would be supplied to the engines with most injurious results. After consideration of the matter, it was believed by the contractors that for the comparatively small amount of gas required at first, the scrubbers which were already in place would clean the gas sufficiently, and in May, 1906, the contractors elected to start the first engine, which was run for public service on the 22nd of that month. The arrangement was that the contractors were to get the engines into running order, and then to submit them to test by the consulting engineers.

Unfortunately, it was found that the cleaning of the gas by the scrubbers was insufficient, and as further engines were started and put into service, the inadequacy of the cleaning of the gas became more and more marked. The cleaning fans, even when erected with their larger motors, were found to be mechanically unsatisfactory, owing to vibration, leading to frequent breakdowns and a return to the dirty gas conditions. While the minor troubles which might be expected in the starting up of a plant of such magnitude—such as lubrication and ignition troubles—were being gradually eliminated during June and July, fresh troubles, due to the dirtiness of the gas, were gradually accumulating. The erecting staff of the contractors was largely occupied in "nursing" the engines taken into service, thus delaying the completion of the rest of the plant, while some difficulty arose through the division of responsibility between the contractors and the municipality's staff who were running the engines for the public service.

In September, 1906, Mr. W. D. Bell, the contractors' managing director, visited Johannesburg, and entered into negotiations, as a result of which, in November, 1906, a new contract was entered into. The contractors undertook to run the plant on behalf of the municipality for 12 months, taking entire charge of the station, and supplying energy at a certain rate per unit. New times of completion were defined within which the contractors were to get the plant into fit condition for the tests defined in the original contract.

It was hoped on all sides that, with the signing of this running contract, the end of the troubles was in sight. The cleaning plant, however, was still unsatisfactory, and as a result the condition of the engines went from bad to worse. It is probably not too much to say that, with the exception of minor troubles at starting up, all the troubles experienced with the engines were due to the presence of tar in the gas.

At the end of March, 1906, an explosion occurred in one of the blowers supplying air to the producers. Four blowers had been specified—all driven electrically—and their switching arrangements allowed them to be driven, either from the traction or lighting bus-bars of the main switchboard, from an independent steam plant in the old town lighting station, or from a small steam plant at the refuse destructor works a short distance away. It would be thought that with four different sources of energy for the blowers, it would have been possible for the contractors to keep them going continuously, but on the evening of March 28th the blowers were accidentally stopped, owing to the mistake of a switchboard attendant, the gas diffused from the producers to the air pipes, producing an explosive mixture, which was fired, either by a spark in the blower house or by the producer fires, wrecking one blower, damaging the producer house and injuring one of the attendants.

The contractors have attributed a large part of their troubles to the fact that the blowers were electrically-driven, but readers of the Electrical Review do not need to be convinced that an electrical drive in itself is quite as trustworthy as a steam drive, and the number of different sources of energy mentioned above show that it should have been possible to keep pressure constantly on the air pipes. The contractors had, from the first, had the opportunity to propose other arrangements if they wished to do so.

During the months of March and April, 1906, the contractors were in a serious financial position. The payments for energy supplied under the running contract were largely counterbalanced by the penalties incurred for interruptions to supply and the contractors' representative in Johannesburg was left almost without resources; indeed, in April, 1906, he wrote to his principals that the municipality was keeping them going. Finally, on May 15th, the contractors threw up the contract on the ground that they were at the end of their resources.

The subsequent history of the contract is a legal, rather than an engineering matter. There is no doubt that the failure of this contract has had a most prejudicial effect on the development of large gas engine and producer plants. Yet we think we have said enough to show that, properly regarded, it is in no sense a proof of the unsuitability of large gas engines using producer gas for the public supply of electrical energy. The proper cleaning of the gas required by the specification, as originally issued, and on the provision of which the consulting engineers, Messrs. Mordey and Dawbarn, had insisted at a very early stage, would have reduced the difficulties experienced in the setting to work of

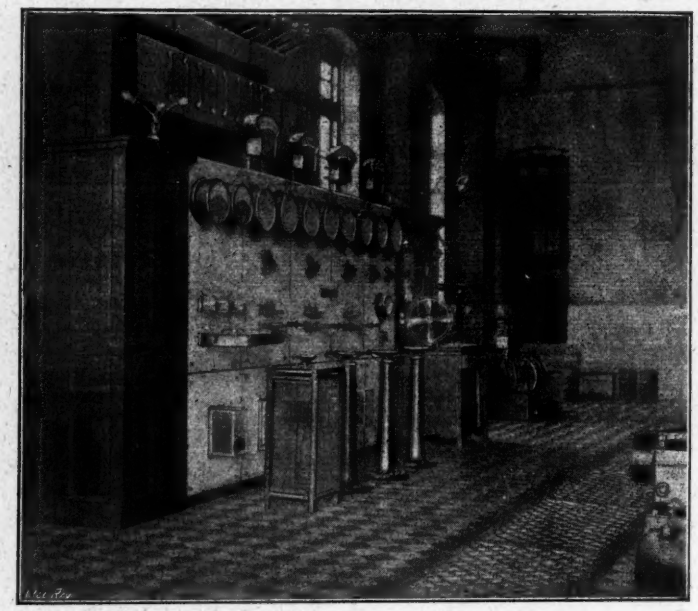
this plant to such minor troubles as are familiar to every erecting engineer, however little they may be remembered after a plant has been set to work.

The Johannesburg matter has been so long *sub judice*, that the actual facts regarding it have not transpired till now. The result of the trial is that the Johannesburg Corporation has been awarded substantially everything for which it sued, and the evidence has shown that the failure was due rather to defective business management on the part of the contractors than to anything inherently defective in the generating plant itself. The contractors had every assistance given them, and on this point Lord Ormidale, in his judgment, makes the following observation :—

"There appears to have been a good deal of give and take on the part of the consulting engineers in order to further the work of the contractors. I think the suggestion that they were obstructive or hostile is totally unfounded. I am also satisfied that at no time did the pursuers deal otherwise than helpfully and considerately with the contractors. They were obviously anxious that this very costly undertaking, which they hoped was to prove of immense advantage to the community, and the demand for the completion of which was becoming more clamant every day, should not be hampered by captious complaints on their part."

The attention given to the generating plant has caused the fact to be overlooked that all the rest of the very extensive power and tramway systems were entirely satisfactory, the original estimates which were so severely criticised locally having been fully confirmed.

We think all parties to this affair deserve commiseration, the Corporation for the loss and inconvenience to which they were put, the contractors for the very serious losses they have incurred due to their failure to realise the conditions necessary to success, particularly in the direction of administration, and the consulting engineers perhaps most of all, for the failure of the power part of the scheme for reasons which had nothing to do with the engineering merits of their recommendation.



The Main Switchboard : Tientsin Electric Supply.

THE ELECTRIC SUPPLY OF TIENTSIN.

Although the Tientsin Gas and Electric Light Co., Ltd., —a British company registered in Hong Kong, bears the combined title of gas and electricity, the supply of the former has been entirely superseded by the latter since 1905, the chief reason being that the production of oil gas was both costly and unsatisfactory.

The attention, therefore, of the directors of the company was called to the production of electricity as the better illuminant, and at a general meeting of the shareholders the old gas company was granted a 15 years' franchise by the British Municipal Council to install an entirely new electrical plant.

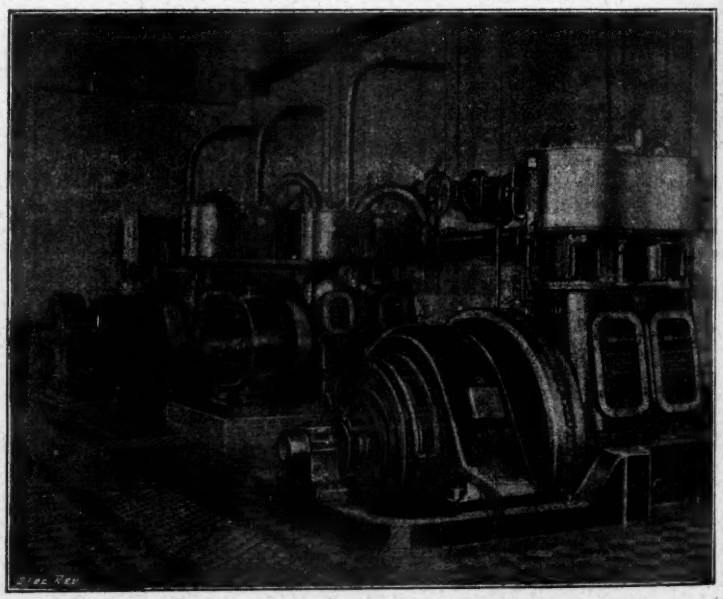
Tenders were invited for the intallation of suitable machinery, and the work was given to Messrs. Arnhold, Karberg & Co., representing the A.E.G., who installed two 80-kw. and one 40-kw. generators, with the necessary boilers and auxiliaries, including an 85 ft. × 4 ft. 6 in. wrought-iron shaft, this portion of the plant being described in the Electrical Review of February 23rd, 1906.

In the early part of 1908 to meet the increasing demand for current an extension of the plant was made in the shape of a new B. & W. boiler and one 175-kw. Belliss-E.C.C. set.

The present plant consists of the following :—

Three B. & W. boilers, two each having 1,426 sq. ft. heating surface, and the third, 2,255 sq. ft. heating surface, all being hand-fired, with a working pressure of 120 lb. per sq. in. without superheat.

The water supply is obtained from the town mains, and is fed to the boilers by four feed pumps (two Worthington duplex, one Mumford compound vertical and one Weir vertical) after passing through a Green's economiser and filter at a temperature of about 200° F.



Generating Plant : Tientsin Electric Supply.

The generating plant consists of four sets, one 40-kw. Robey-A.E.G., two 80-kw. Robey-A.E.G. and one 175-kw. Belliss-E.C.C., each set being capable of dealing with an overload of 20 per cent. for two hours. The machines generate direct current at a pressure of 440-500 volts

across the outers of a three-wire system having five feeding points.

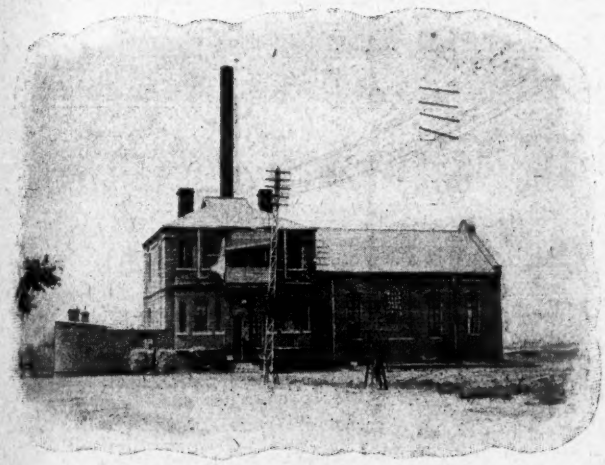
The balancing of the network is performed by four static balancers on the Dobrowolski system, each connected to its own generator by slip-rings.

The switchboard for the first three generators was made by the A.E.G, and for the fourth by the B.T.-H. Co. All four machines have B.T.-H. meters to record their outputs.

Tientsin Electric Supply: The Engineer's House.

The exhaust steam of the four sets passes through an oil separator into a Worthington condenser having 700 sq. ft. cooling surface, the circulating water for this being obtained from a creek which passes close to the works and is always capable of an ample supply.

The mains are all carried overhead on lattice or C.I. tubular poles in the chief thoroughfares of the settlement, and on Oregon pine poles in the outlying districts.



The Generating Station, Tientsin G. and E.L. Co.

The five feeders, each averaging ¾-mile in length, have a sectional area of ·12, ·06, ·12 sq. in., and about 25 miles of distributors have been erected.

The European staff consists of Mr. G. Paton, A.M.I.E.E., A.M.I.M.E., chief engineer, and one foreign assistant, the secretarial work being carried out by Messrs. William Forbes and Co.

The rest of the staff are all Chinese, some of whom have been with the company since its formation.

Exhibition Competition: Result.—The first competition arranged by the Electric Supply Companies at Olympia was one that was open from Wednesday, October 4th to 11th, in which competitors had to submit schemes for the selection and placing of everything electrical required in a modern five-roomed villa. A large number of prizes were offered, and we learn that the winner of the first prize (electrical goods to the value of £30) was Mr. S. Laughton (St. Mark's Electrical Co., 181, Victoria Park Road, N.E.). The competitors were very numerous, and the prize winner is to be congratulated upon his success in submitting the best scheme. We understand that he went about his selection, cost investigation, and testing of the variety of articles required for the villa on the different stands at the Exhibition in a very systematic manner, the economic current-consuming qualities being taken into account in submitting his proposal.

THE ELECTRICAL EXHIBITION.

By "MIDLAND."

"Olympia, 1911," has come—and gone. How much we had expected! But how much have we realised? The Exhibition had many good features, but none of salient merit. Its virtues were ordinary, but its defects were many and of considerable importance. The writer had exceptional opportunities of obtaining the views of stall holders and visitors, technical and non-technical, and he trusts that the following notes may be accepted as a frank, unprejudiced and tolerably representative criticism.

The main object of the Exhibition was to bring prominently before the public new applications of electricity. Technical men, who are actually or prospectively in the market for electrical equipment of any nature, can be secured as customers without the aid of exhibitions, but the latter are, if properly managed, of the greatest value where the general public is concerned. In order, however, that the public may be influenced by the Exhibition, the public must be persuaded to attend the show, and in this direction enterprise has been flagrantly wanting. Before the opening of the Exhibition, none but the most inconspicuous posters, and few enough of these, were shown in railway stations and on hoardings, &c.; the earlier advertisements in the daily Press were insignificant. After the show had been open a week or 10 days, greater newspaper publicity was secured, but well-founded rumours were current that a number of the larger exhibitors contributed a large part, or even the whole, of the cost of these notices (the advertisements of individual firms were, of course, entirely at the expense of the latter).

As usual, stall holders were provided with adhesive stamps (announcing their intention to exhibit at Olympia), some months before the opening date. These stamps were generally used indiscriminately on every letter dispatched by the exhibitors, but their value may be doubted. They never reached the general public, and, to business firms, they developed into a nuisance. The main result of this persistent announcement, so far as the regular customers of exhibitors were concerned, was to create a wide demand for complimentary tickets. Regular clients could reasonably expect these from their business friends exhibiting, but in few cases would the requests have been made had the customers known that each "complimentary" ticket cost the donor 4d.

Next to the wretched publicity arrangements, the extraordinary dearth of free or really cheap tickets for use at the discretion of stallholders formed the basis of most general indignation. Several influential exhibitors expressed the view that central stations, which, after all, reap the most lasting benefit from the Exhibition, might have contributed to its success by distributing complimentary tickets (even if the latter had to be bought) among their consumers.

Apart from the ineffectual measures taken to secure a large public attendance—and one looked in vain for the crowds and general briskness and enthusiasm of the 1905 Exhibition—the Exhibition was not representative of the industry. Even a casual glance down the official catalogue of exhibitors reveals the absence of a number of very important firms. Many are the excuses made—publicly and in private—for this absence; some firms are "too busy in their shops," others aver that what business they cannot get without Exhibitions they are not likely to secure by their aid; others, again, remark tersely that "it does not pay."

The provincial sales manager of an important electrical firm assured the writer that the Exhibition at Olympia was little heard of in the provinces before its opening. Having travelled from the Midlands to take charge of the Exhibition business for his firm, he was leaving town after only two days. He placed the Exhibition work in the hands of a junior, regarded his Midlands work as far more important, and considered the Olympia Exhibition "an insult to the trade." This was the deliberate opinion of one whose views were worth noting.

Let us now consider a few of those details of arrangement on which the success of any Exhibition so largely depends. The management offices were in a dark and inaccessible corridor, and the names of the temporary occupants of the

various rooms were inscribed in ordinary typewritten characters on tiny sheets of paper stuck on the doors. Fully a dozen people, in two days alone, asked the writer for the management offices or Mr. So-and-So's room, after actually passing along the corridor flanking these rooms.

Visitors desiring a rest after the weary work of pacing the main hall had admirably comfortable seating accommodation in the gallery—the said accommodation being provided gratis by an outside firm merely to advertise its seductive products. Of writing accommodation, such as one might legitimately expect in an Exhibition of this nature, there was none, and did one trespass into the deserted Press room (the lighting switches for which could be found outside after ten minutes' patient search had exhausted every possible hiding place within the room), one speedily realised the reason for its desertion and left the spot with alacrity. A more cheerless room could hardly have been chosen for such unfortunates as were compelled to record their impressions upon the premises; a considerable unfavourable bias must have been automatically imposed on their writings! (N.B.—The present notes are *not* written in the Press room; the memory alone of the latter suffices!)

When the average man attends an Exhibition he expects to be provided with a little music by way of diversion, and in view of the importance of ladies' decisions in influencing the adoption of much of the apparatus shown, one would have expected the engagement of a good brass band as a matter of course. Actually, the stall-holders had to agitate vigorously before any band at all was provided, and even then the mistake was made of engaging a string band, the strains of which could be faintly heard at some parts of the Main Hall during a temporary lull in the clatter of running machinery.

Recent notes on the external illuminations of Olympia have had one fault; they have not been sufficiently caustic. The effect of the illuminations was ludicrous; for a considerable part of the Exhibition the right-hand searchlight (facing the entrance) gave a very poor beam, and the left-hand lamp giving an exceptionally good light, the inferiority of its fellow was the more noticeable. The "lightning" flashes might have been a little brisker; the "fountains" gave one a weird impression of black bands running up the centre (though the down-falling streams were much more natural). Apparently the waving flag was too ambitious—the writer never saw it lighted, much less in "motion." The poor show made by arc lamps, and the general gloominess of the Exhibition building from without, have already been criticised by the Union Electric Co.

As regards the arrangement of the stalls themselves, the appearance of the buildings was, on the whole, less artistic than in 1905. Many most interesting and valuable Gallery exhibits were very poorly displayed. This (the fault of the exhibitors), together with the ragged appearance of the roofs of the Main Hall stands, gave the Gallery a sort of third-rate, back-of-beyond appearance, which was certainly unfair to exhibitors. There should be no difficulty in arranging to finish off the Main Hall stands so as to present a neat, if not an artistic, appearance from the Gallery. By finishing off the tops of their stands and displaying suitable wording and flash signs, most of the exhibitors could have materially increased the attractiveness and advertising value of their stalls.

There was the old difficulty in finding the makers of a speciality known by some trade name, when one could remember the latter, but not the name of its producers. The addition of an alphabetical "Speciality Index" to the official catalogue would remove this trouble, and the moderate cost of its preparation would, doubtless, be borne *pro rata* by the firms benefited.

Very bitter protests were raised by a number of stall-holders against the admission of a certain few, entirely non-electrical, exhibitors; the latter gentlemen, by their characteristic methods of soliciting attention, did no small injury to their neighbours, who had not even the consolation of knowing that it was their own industry which was benefiting. Visitors and electrical exhibitors will, doubtless, appreciate the allusion and its importance.

Many more plaints might be urged, but the above covers the more noticeable and serious shortcomings. So far as the writer's own feelings, and those of practically every authoritative person with whom he has discussed the matter are concerned, "Olympia, 1911," has been a woeful disappointment—far below the 1905 Exhibition, and in appearance, interest and success, inferior to many non-electrical exhibitions occupying the same site since that date.

Let us apply the lesson of our present disappointment to the future; 1917 is still far off, but, as it approaches, let us remember 1911, and to good effect.

NOTES FROM CANADA.

[FROM A SPECIAL CORRESPONDENT.]

Lethbridge, a rapidly growing town in Alberta, has recently decided to have an electric tramway. The power plant, which is steam driven, is to be enlarged to the extent of some 1,500 kw., and about 10 miles of track will be laid down as a beginning with 10 or 12 cars.

Hydro-electric plants being liable to give trouble in the winter owing to ice, and in the summer to shortage of water, the Winnipeg Electric Railway Co. are adding to their steam plant so as to bring its total capacity up to about 20,000 h.p.; this will be kept ready to operate, at short notice, at any period of the year.

A Government report recently published on the water powers of Canada contains the following figures as estimates:—

	Possible h.p.	h.p. developed or being developed.
Yukon	470,000	55,000
British Columbia	2,065,500	150,100
Alberta	1,144,000	12,000
Saskatchewan	500,000	—
Manitoba	504,000	160,000 about
North-West Territories	600,000	—
Ontario	4,308,475	350,000 about
Quebec, exclusive of Ungava ...	6,900,000	125,000
New Brunswick	150,000	9,080
Nova Scotia	54,000	13,300

The Commission of Conservation is obtaining very complete information respecting all the water powers of Canada, and it is expected that a report on this important subject will be forthcoming before very long.

New rules for electric wiring are to come into force in 1912. It is understood that these will call for wire similar to that used in England; several of the cheaper grades at present in vogue in Canada will not be allowed in future.

The telephone companies here have a very convenient system for long-distance calls which might very well, one would think, be adopted at home.

If Mr. A. in Montreal wishes to call Mr. B. in Oshawa he merely asks "Central" to get him Mr. B. at Oshawa. As this is a small place it is not even necessary for Mr. A. to inform "Central" where Mr. B. is likely to be found. They will get him some time during the day at his hotel or his office or elsewhere. In the event of Mr. B. having left Oshawa for the day, "Central" is almost certain to ascertain this fact, and will inform Mr. A. not only that he has gone away, but to what other place, and will be quite willing to get him from there if it be possible.

Take now the reverse case, Mr. B. in Oshawa calling Mr. A. in Montreal. The latter city being a large place, it will be necessary for Mr. B. to inform "Central" that Mr. A. is staying at such an hotel or that he is expected to be in So-and-So's office at a given time. If at all possible, "Central" will get Mr. A. and ring up Mr. B. some time during the day.

The great point about this system is that no charge is made unless and until the man with whom one wishes to speak is actually brought to the telephone, even though a dozen attempts have to be made to get him.

Another good arrangement is the system of charging one-half the day rates for night calls. This applies also to telegraph rates, 25 words costing 25 cents in the daytime, while 50 are allowed at night for the same sum.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Demand for Technical Men.

As an engineer engaged on the manufacturing side of electrical engineering, I should like to endorse the views of "Aving Sum," as expressed in the last issue of the ELECTRICAL REVIEW.

To begin with, low salaries are just as much in evidence in works as they are in central stations.

I have had experience in two of the largest firms in this country, and I may say that the average wage of a college man is 30s. to 35s. per week. He is usually employed on the test bed or the calculating branch of the design department.

I know a man who has been to college for two years, and afterwards served two years in works, who is getting £1 per week at testing. For further examples, see the advertisement columns of the ELECTRICAL REVIEW.

Incidentally, by way of comparison, I may add that the standard wage for fitters is about 38s. week. This gives one a fair idea of the pecuniary value of a college training. To all appearances, it has a negative effect. No wonder the numbers are dropping off at our various technical schools.

It will be found that, in general, the technical engineer receives a lower salary than his *confrère* in other departments. And the irony of it all is, he has perhaps spent hundreds of pounds on his education. He may also, like myself, have served a recognised apprenticeship to mechanical or electrical engineering—or both.

In many cases there is a prejudice against college men, and I heard of one assistant manager of works who said he would not have one in the place if he could help it.

Technical training will never count for much, so long as every Tom, Dick and Harry can call himself an electrical engineer without such qualifications. To remedy some of the aforementioned evils, I would suggest that the professors of our various engineering colleges should draw up a scheme for a professional union of qualified engineers.

This has been done in the medical, the legal and other professions. Why not in engineering?

By means of advertisements, it would be very easy for each professor to get into touch with his old students, and I am certain the majority would welcome such an arrangement.

Such an innovation would also give some stimulus to our technical colleges. Parents don't like the idea of spending £500 or £600 on a college education for one of their sons, and then find that he earns 30s. to 35s. per week for the best years of his life.

Wilkins Micawber.

As an old student of your paper, I should very much like, without unduly prolonging a discussion, to pass a few comments upon your correspondent's letter bearing the title "Demand for Technical Men." With reference to your correspondent, "Aving Sum," and all due courtesies to his views of the case, I beg to state that the term "technical men" is vastly misrepresented. For instance, in quoting the instance of as many as five B.Sc.'s applying for a position of 30s. per week, I should like to say that, from an employer's point of view, this would about represent their worth. I have met many highly theoretically-trained men, who have not been worth their presence as ornaments, simply because they have the knowledge, and are afraid to use it for the fear of soiling their hands. On the other hand, the electrical trade is simply glutted with mere labourers, men who can do a thing if they are shown what to do, but the men that understand how the thing is done, why it is done, and can instruct others to do the certain thing, are not to be found. The cry of all large electrical firms is the same; the men they want they cannot get. The college-trained man is practically useless at the outset of his career, from a business point of view, and it is eminently the business point a firm has to look at. But in all branches of engineering, not exclusively electrical, what is wanted is the practical theoretical man, and not a trained ornament bearing degrees and not daring to demonstrate his knowledge. Mention is also made of managers not attaching any great importance to technical training. If he did but know that the largest firms in electrical work cannot get their men to train technically, let alone not wanting them! But, as before stated, the whole crux of the matter is, "there is the greatest scope possible in the electrical field, but we must have co-operation of theoretical and practical work."

Walter Beckwith.

October 21st, 1911.

I notice, in the issue of October 13th, that you advise parents to place their sons in electrical engineering. I also notice, that in a footnote to "Aving Sum's" letter, you profess sympathy with the generating branch of the profession. You qualify this latter remark by a statement that it is only one branch of the profession.

That is so, but I venture to say that to about 75 per cent. of technical students and premiumed apprentices, electrical engineering means a shift job with poor salary. It is all very well for technical colleges, training schools and manufacturers, to enlarge on the hypothetical possibilities of their particular courses of study and pupilage, but are these glowing statements supported by facts? "Aving Sum's" letter was an under-statement of the case.

I should like to see a list of names of their students compiled by the Central Technical College and Faraday House, with the dates of each pupil's course, and his present appointment and salary, and also a similar list of the Brush Co.'s pupils.

I am a product of the premiumed pupil and technical college process, and up to the present I have only secured shift jobs, and poorly paid posts they have been when the outlay on my education is considered. It is certainly an unpalatable state of affairs, when manufacturing firms demand an excessive premium, sometimes as much as £300, and turn out their pupils, after three years, with only the qualifications of a second-rate fitter—and a testimonial; or (as happened to a friend of mine) secure the unfortunate pupil a post as switchboard attendant at a salary of 16s. per week.

The conditions of labour and salaries of central station engineers are a scandal to all concerned. It is full time that an attempt was made to find a remedy. The law of "supply and demand" is not alone responsible for this uneconomic condition. Might I suggest, Sir, that your sympathy should take a practical form—a campaign among chief engineers and managers, with a view towards inculcating a little professional pride, and acquainting them with the fact that the 56-hour week 40s. shift man is a brother engineer.

This could be accomplished through the medium of the REVIEW, which is undoubtedly the organ of the classes and masses of the electrical industry.

A. B. Fastman.

Greenwich, *October 24th*, 1911.

Quartz in Electrical Heaters.

In reference to our communication of October 6th, we note a reply from Mr. Alfred A. Newman in your current issue. We are sorry to find, however, that this displays such a crass ignorance of the subject under discussion as to be almost unworthy of serious attention on our part. However, in order to avoid any misapprehension, we may point out that we are dealing strictly with facts, which are incontrovertible, and open to proof by any of your readers so inclined. Does Mr. Newman desire to insinuate that the firms we have mentioned, viz., Messrs. Hoskin's Manufacturing Co., Detroit; Bristol Co., New York; Heraeus Hanau, &c., are "unsuccessful experimenters" in the use of quartz for electrical heating apparatus? The above-mentioned firms have a world-wide reputation, and have sold some thousands of electrically-heated quartz appliances, and probably use more quartz in a day than his friends the Bastian Electric Heating Syndicate use in a month. The first-named firm are also the owners of, and control the patents and manufacture of, "Nichrome" resistance wires in the United

States, which Mr. Newman admits the Bastian Electric Heating Syndicate have only been using for the past two years, from which time dates the success of their quartz appliances, but which, as a matter of fact, has been used by the Hoskins Manufacturing Co. and other firms, including ourselves, for the past six years in connection with the manufacture of electrically-heated quartz appliances. We must decline to admit that mere presence at Olympia constitutes a criterion, or is even representative of what has been done in this direction up to the present time. Our only object in entering into this correspondence is to see that credit is given where credit is due, and certainly no credit is due to Mr. Bastian as the originator of quartz for electrical heating purposes, whatever may be due to his particular arrangement of details and to his efforts to advertise his wares. Your correspondent's query as to "who we are," does not affect the question to any extent, and may be dismissed with slight attention; we may, however, inform him that we are manufacturers of electrical heating and cooking apparatus of 10 years' standing, and we can assure him that we possess a thorough knowledge of this subject and business, and our appliances are certainly not "laboratory experiments," as he suggests. If so inclined, we might with equal pertinence inquire who Mr. Newman is?

In conclusion, we would suggest that he makes a study of this interesting subject and obtains some knowledge of what has been done in this direction, when we shall be pleased to discuss the matter further with him.

Paterson & Co.

Newcastle-on-Tyne, *October 23rd*, 1911.

[We have ventured to abbreviate Messrs. Paterson's letter somewhat.—Eds. E.R.]

Olympia Electrical Exhibition.

I am glad Mr. Benjamin has corrected my misapprehension as to the issue of free tickets at Manchester. My memory had taken me back to Olympia Exhibition in 1905, where exhibitors received a quantum of free tickets, and the interest of the supply authorities was so stimulated that they subscribed for 120,000.

It is useless to thrash a dead horse, but in view of future exhibitions it is not useless to seek reasons for the poor attendance, especially during the first two weeks.

With regard to the price of space, "The Electrical Exhibition" draws a wrong conclusion. The return of space money to space hirers can only be from a percentage of the realised surplus, and cannot materially affect the exhibitors' expenses. What is wanted in an exhibition promoted by the N.E.M.A. is not a money surplus, but increased trade, and this, I contend, should have been secured by more liberal advertising, better illumination, the securing of effective support from the supply authorities, a flat-rate of admission, and greater encouragement for ticket issue.

Justus Eck.

Chiswick, W., *October 23rd*, 1911.

Electricity and the Lay Press.

From his article, "Electricity and the Lay Press," Mr. Goody seems to think that electricity is especially singled out for vituperation by journalists. I perfectly agree that the ignorance betrayed is phenomenal, and that gas receives more favourable treatment, but this arises probably from the fact that gas is more easily understood. It generally happens, however, that those whose work is beyond the comprehension of the common mind suffer at the hands of the newspaper critic. To mention only one example, W. P. Frith, R.A., in his "Autobiography" and "Further Reminiscences," inveighs freely against the incompetence of art critics. He is certainly justified by one example given: "'To Arms, ye Brave.' A parcel of people exposing themselves in a manner that calls for the interference of the police." I think that one observation of his is as completely applicable to modern criticism of electrical matters as to the art criticism to which he refers:—"If the public could only be persuaded that painted opinion is but that of a gentleman or lady who can have no technical knowledge, and which, if expressed *viva voce* in general society, would have little or no effect, it would appreciate public art criticism at its true value."

With regard to the invariable statement that any fire was caused by a fusing electrical wire there is an additional cause. The critic above-mentioned sets out to criticise art, the reporter of fires has many other things, from police court cases to religious meetings, to which to attend, and he has to dismiss each in as little time and with as little thought as possible. The penny-a-liner in search of copy doubtless finds a phrase so universally accepted invaluable to earn a penny. To his remarkably catholic collection of achievements he cannot add meticulous accuracy. It hardly seems feasible that this class is subsidised directly by the gas interest, it seems more probable that the newspaper proprietor controls that interest.

R. S. T. V.

Rugby, *October 17th*, 1911.

Trade Discounts to Private Consumers.

With reference to the letters in your last issue from Messrs. C. G. Fox and P. A. Reed, although I said in my letter that the wiring prices are cut, I did not say I did wiring at cost price. My argument was that we very often have to pay the carriage on and wiring of fittings out of the amount allowed as trade discount. I quite agree with Mr. P. A. Reed that manufacturers should not supply private people below list price, and if it pays them to keep the whole trade discount for themselves, that is their look out. But from a contractor's point of view, the contractor will naturally influence his clients to deal with those manufacturers who look after his interests. I don't suppose any manufacturer wants to give anything for nothing, but there are many who find it pays to treat their contracting friends well.

A. F. Lord.

Plymouth.

H. B., Hampstead.—Address not enclosed.

A VARIABLE LOW RESISTANCE.

In *The Physical Review* of September, 1911, Mr. J. H. Dellinger gives an account of a convenient low resistance, of small total resistance, capable of definite variation in steps as small as one-millionth of an ohm, which introduces no irregular variable resistance. It consists of an amalgamated copper wire plunging in a tube of mercury. The idea has been used in various forms by many experimenters. In the device here described, the copper wire is used to short-circuit the mercury, the operation depending on the fact that mercury has approximately 60 times the resistivity of copper. This principle has a notable advantage in alternating-current work, as explained below. The apparatus consists simply of a tube of thin glass, or of porcelain or hard rubber, with a slight enlargement at the upper end to receive the mercury when displaced by the descending copper wire. An amalgamated copper wire, of slightly smaller diameter than the internal diameter of the tube, is lightly gripped, either by a cork placed in the top of the tube or by a pair of springs faced with insulating material. A length of 15 cm. is convenient. A 1-ohm range is obtained by using a tube of about 0·4 mm. diameter, and any other range down to 0·01 ohm is obtained by tubes up to 4 mm. diameter. The leads are connected to the top and bottom of the mercury column, and the plunging copper wire functions simply by short-circuiting the mercury. A simple and valuable modification is the use of two of these resistances in series by the employment of a glass U-tube, of which the diameter of one leg is $\sqrt{10}$ times the other. Thus a pair of variables of the ranges 0·1 ohm and 0·01 ohm are conveniently obtained. The use of the U-tube eliminates the difficulty of sealing the lower end. A scale may readily be attached, and when the instrument has been calibrated the resistances of its settings are known. The instrument should not usually be used for exact quantitative work, however, as it has a large temperature coefficient. The mercury variable resistance has been applied to facilitate adjusting to a balance the auxiliary ratio arms of the Thomson bridge, in the comparison of low-resistance standards, and its use materially increases the speed of working. It is especially valuable in the measurement of the resistance of wire samples for determination of the conductivity, since the magnitude of the ratio arms may be very different for every sample measured. It has also been found to be a convenience in the comparison of mercury ohms with wire standard ohms, since the potential leads of the mercury standards are of relatively high resistance with respect to the ratio arms. This apparatus has also been usefully applied to the regulation of potentiometer currents. The application

of this device to alternating-current bridge work has been productive of good results. The precision of determination of low inductances may be increased by the use of ratio arms of lower resistance. This has been made convenient by the use of the mercury variable resistance. It has been found that, fortunately for alternating-current work, this variable resistance has practically non-variable inductance (at any rate for moderate frequencies). This is evident, if the copper wire is of practically the same diameter as the mercury column, as the geometry of the circuit is not changed by varying the resistance. Thus this instrument is a complementary apparatus to the usual variable inductance. The total change of inductance of one of these "mercury variables," 15 cm. long, about 1·5 mm. internal diameter of tube, 1 mm. diameter of copper wire, and a range of 0·05 ohm, was 6×10^{-9} henry, or 6 centimetres.

WILLANS-DIESEL OIL ENGINES.

On Monday last we paid a visit to Messrs. Willans & Robinson's Victoria Works, Rugby, to inspect a pair of the company's standard 4-cycle 4-crank engines on the Diesel principle, which have been built to the order of the Alianza Co., Ltd., of London, for the lighting and driving of their nitrate works at Bellavista, in the Argentine Republic, to the specifications of Messrs. Strain & Robertson, of Glasgow. Each engine is coupled direct to a three-phase generator built by Messrs. Siemens Brothers Dynamo Works, Ltd., under a separate contract. We give an illustration of the combined set herewith.

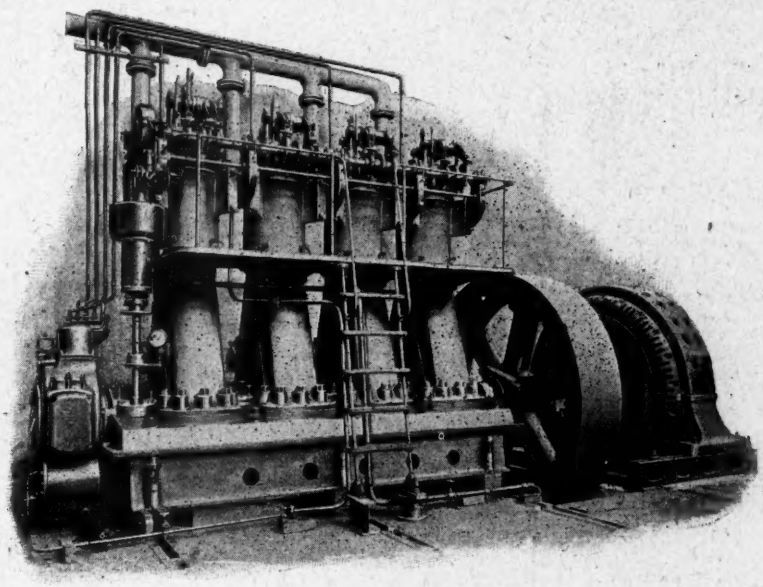
The normal output of each engine is 335 B.H.P. at 220 R.P.M., with an overload capacity of 10 per cent. for two hours; in the present instance, however, it was necessary to run the engines at a lower speed (187 R.P.M.), developing 280 B.H.P. at full load, and 325 B.H.P. for two hours, at sea level. The site on which they will be installed is about 3,200 ft. above sea level, and at this altitude they will be called upon to give 200 B.H.P. and 230 B.H.P. as normal full load and overload respectively.

The alternators, with exciters direct-coupled, work at 220 volts; each is rated at 175 K.V.A. with a power factor of 0·8 at full load, and has an overload capacity of 25 per cent. The sets are intended to run in parallel, and were tested on two days last week, under the supervision and to the satisfaction of the consulting engineers. The specified tests included 24 hours' run at full load (280 B.H.P.), followed by a two-hour run at 15 per cent. overload, and one hour each at ¾, ½ and ¼ load, fuel consumption tests being made at each load, in addition to stringent tests as to the ability of the sets to run well in parallel and governor tests. The guaranteed fuel consumption figures were as follows:—

15 per cent. overload	...	...	...	0·44 lb. per	B.H.P.-hour.
Full load	...	...	...	0·44	„ „
¾ load ...	...	...	...	0·46	„ „
½ load ...	...	...	...	0·52	„ „
¼ load ...	...	...	...	0·72	„ „

with a margin of 5 per cent. to allow for the newness of the engines.

The total overall length of the set is 28 ft. 9 in.; width, 11 ft. 6 in.; and height, 11 ft.; and the total weight is about 57 tons. These two sets are identical with two sets recently supplied to the works of the Rosario Nitrate Co., of London, in Peru, which also passed the tests of Messrs. Strain & Robertson satisfactorily. At the time of our visit one of the sets was running on full load without noise or vibration.



Willans-Diesel 175-K.V.A. Generating Set.

A Johannesburg Fatality.—A Cape correspondent states that a terrible fatality occurred at the Robinson central branch of the Victoria Falls power station recently. A young German, named Heintz, was engaged in tapping the wires, when, through some misunderstanding, apparently, the current was switched on, and the man received a shock which burnt every stitch of clothing from his body in an instant. The naked body was also burned from head to foot, the arms and legs being practically frizzled and skinned. He was taken to hospital, where he died in a few minutes in frightful agony.

Exhibitions.—The *Times* reports that the New South Wales Chamber of Manufacturers supports the idea of an Empire Exhibition in London in 1914.

According to the *Standard*, an International Exhibition is to be held at Dunkirk from May to September, 1912. It will be under the official patronage of the municipalities of Dunkirk and Malo-les-Bains. Among the sections will be those relating to industry and science respectively.

LEGAL.

A Greenock Tramway Case.

Proof is being heard this week and next, by Sheriff Welsh in the Sheriff Court in an action raised by the Greenock and Port Glasgow Tramways Co., Ltd., against a Glasgow foundry company and a local company of contractors. The pursuers claim compensation for damage alleged to have been caused to their tramway track in Main Street, Greenock, by the haulage of heavy machinery and boilers over the roadway there, and they seek to have the conveyance of such loads over the tramway track prohibited. The contention of the pursuer is that through the conveyance of the heavy haulage over their lines, their track has been broken and destroyed and the service interrupted. They argue that the traffic is not of the ordinary kind that it should continue without compensation, and they ask interdict prohibiting defenders from so using the track. They estimate the damage at £350 but sue for what they characterise as a moderate sum, £67 17s. The case for the defenders is that the present method of traffic has been followed since 1901. This traffic they affirm is merely the ordinary kind in connection with the shipbuilding industries of the town. Had pursuers, they say, laid down granite setts of good quality on substantial foundations, as they ought to have done, no damage would have been caused, or, at any rate, it would have been greatly lessened. They repudiate liability, and oppose the claim for interdict.

Attorney-General *v.* The Mayor and Corporation of Sheffield.

This case was mentioned on Monday, October 23rd, to Mr. Justice Eve in the Chancery Division.

Mr. Sargent, for the defendant Corporation, asked that the case might be postponed. It was stated that it related to the carrying on of an electrical business. The case was then postponed, to be heard not before November 7th.

British Westinghouse Electric and Manufacturing Co., Ltd., *v.* The Electrical Co., Ltd.

Counsel on Tuesday applied to the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Moulton and Farwell, to allow the defendant company's appeal, which had been entered from the judgment of Mr. Justice Swinfen Eady, to stand over till November 20th, as he said there was a prospect of the parties arriving at a settlement.

The application was acceded to.

The T.F. Syndicate, Ltd.

In the Chancery Division on Friday, October 20th, Mr. Justice Joyce heard a motion in the debenture-holder's action of Churchman *v.* The T.F. Syndicate, Ltd., which carries on the business of manufacturing filaments for electric lamps.

Mr. Galbraith stated that the plaintiff was the holder of £950 worth of debentures, and asked for the appointment of a receiver

and manager. There was a considerable quantity of these filaments in stock.

The company appeared and consented to the appointment and submitted to the usual judgment in a debenture-holder's action.

His Lordship made the orders asked for.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Winton" writes:—"Referring to the case of a company or corporation letting out wiring installations, on the free wiring system, at a rental of so much per quarter, the Electric Lighting Act of 1909, Sec. 16, states, among other things, that—'All electric lines, fittings, apparatus and appliances, let by any undertakers on hire, or belonging to any undertakers, but being in or upon premises of which the undertakers are not in possession, shall . . . . . at all times continue to be the property of, and be removable by, the undertakers . . . . Provided that such electric lines, fittings, apparatus or appliances, have upon them respectively a distinguishing metal plate, affixed to a conspicuous part thereof, or a distinguishing brand or other mark conspicuously impressed or made thereon sufficiently indicating the undertakers as the actual owners thereof.'

"So far as I am aware, it is the general custom to label these installations by a single metal plate, fixed on or near the undertaker's meter board, stating that—

"'This installation is the property of the
..... Company or Corporation.'

"The query now arises, however, as to the word 'respectively' in the above quoted section. Does this mean that every switch, lampholder, ceiling rose, and different wires must all be labelled, or is the above single plate deemed sufficient in law to proclaim the ownership?"

*** It could hardly be the intention of the legislature that every piece of apparatus which goes together to make up an installation should be marked with a plate. The section must be interpreted by the aid of the words "sufficiently indicating the undertakers as the actual owners thereof." If the inscription on the plate were so framed as to indicate (to the uninitiated) what was included in the word "installation," it is conceived that such an inscription would suffice to comply with the requirements of the Act.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Witton" Fool-Proof H.T. Control Panel.

We illustrate herewith a compact arrangement of control panel for a three-phase high-tension motor or feeder—the design of the General Electric Co., of Witton, Birmingham. This consists of a boiler-plate cubicle suitable for fixing to the wall.

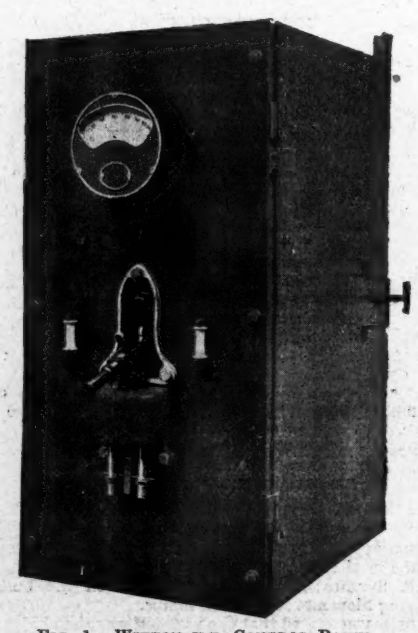


Fig. 1.—Witton H.T. Control Panel

The cubicle contains three single-pole isolating links; a three-pole automatic switch; also the necessary current and potential transformers for operating the trip coils or oil switch, &c., and an ammeter or wattmeter, the latter fitted on the front of the cubicle above the oil-switch operating handle.

The special feature about this cubicle is that the arrangement of interlocking the various pieces of apparatus with the door renders it absolutely fool-proof. The isolating links are interlocked with the doors of the cubicle in such a way that the action of opening the door also opens the links. The door is further interlocked with the oil switch, so that it cannot be opened until the switch is in the

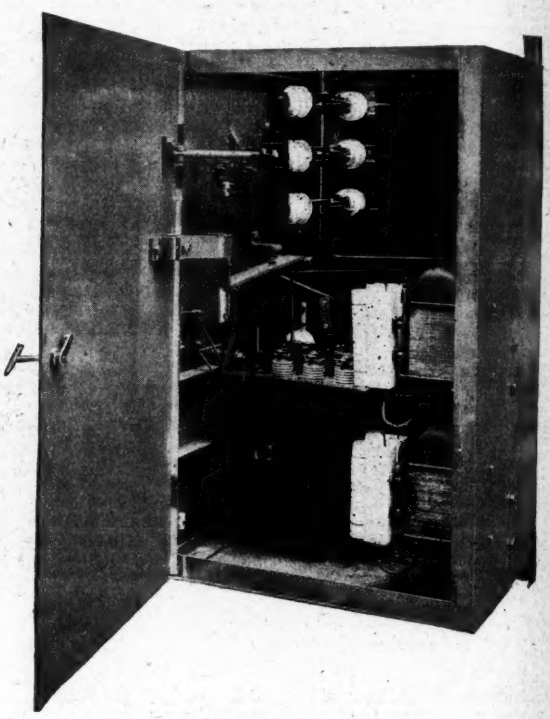


Fig. 2.—Showing Interior of Witton H.T. Panel.

"off" position; also, the oil switch cannot be closed until the door of the cubicle is closed. It will thus be seen that it is impossible to either make or break the circuit by means of the isolating links.

Careful attention has also been paid to efficiently isolating the "line" sides of the isolating links by means of insulating barriers, so that it is impossible to touch any live parts when the door of the cubicle is open, and consequently adjusting and cleaning of the various apparatus can be done in absolute safety.

The "Powerful" Tool Holder.

Amongst the novelties shown at Olympia by Messrs. Geo. W. Goodchild & Partner, of 30 and 32, Farringdon Road, E.C., was an improved lathe tool holder. The special feature of the

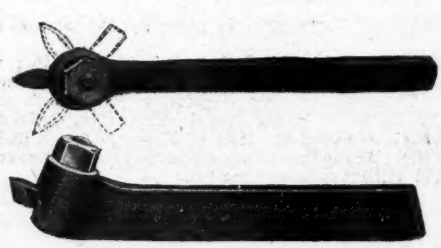


Fig. 3.—"Powerful" Tool Holder.

device is the provision of grooves in the end of the holder which permit the tool to be rigidly held in any of the three positions shown in fig. 3, thus making the holder of practically universal application, whilst retaining extreme simplicity.

New Projector Lamp.

The Regina Electric Co., Ltd., of Cologne-Sulz, Germany, have recently brought out a new projector lamp intended especially for use in bioscopes where the supply pressure is 100 or 110 volts. In the ordinary way, unless a motor-generator is used, the lamp takes, say, 40 amperes at 45 volts, and the excess voltage is wasted in resistance, the power lost being much greater than that usefully employed. The new lamp, we are informed, works with 70 or 80 volts across the arc, and takes a current of only 20 amperes, while yielding the same light as a 40-ampere 45-volt arc. Thus the loss is greatly reduced, being, in the case mentioned at 110 volts, only

600 watts instead of 2,600; and the total power consumed is halved. The carbons used cost no more than those used in the ordinary lamp, and are automatically fed; adjustments for the length of the arc and for focussing are provided.

Electric Fittings.

In their recently issued catalogue of electric light fittings the the Metallic Seamless Tube Co., Ltd., of Wiggin Street, Birmingham, show a variety of choice designs of art metal work. A line of black iron and copper wall lanterns particularly catches

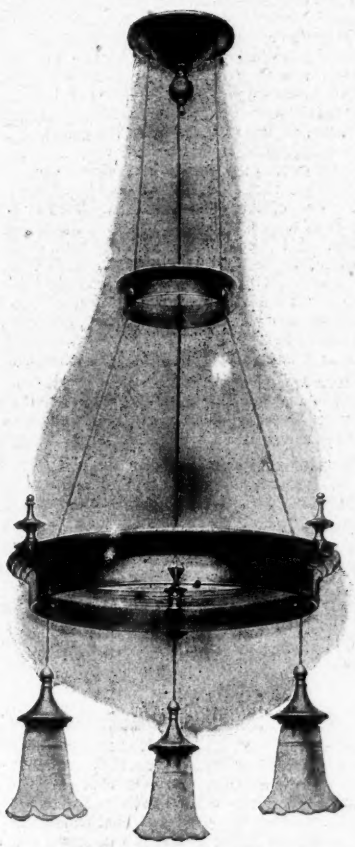


Fig. 4.—Metallic Seamless Tube Co.'s Pendant Fitting.

the fancy, and there are hall lanterns in polished brass or oxidised copper and silver, table standards and wall brackets, ceiling fittings and electroliers. A typical rise and fall pendant fitting for three lights with 18-in. band is illustrated herewith. It is supplied in polished brass, or oxidised copper or silver finish.

BUSINESS NOTES.

Dissolutions and Liquidations.—Beck Flame Lamp, Ltd.—This company is winding up voluntarily for the purpose of reconstruction Mr. H. J. Page, 21, Ironmonger Lane, E.C., liquidator. A meeting of creditors is called for November 6th, at Winchester House, E.C.

Winchester Electric Light and Power Co., Ltd.—A meeting of creditors is to be held at Broad Sanctuary Chambers, Tothill Street, S.W., on November 1st.

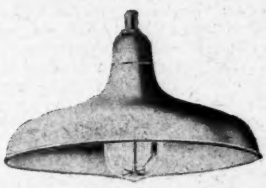
Electric Fog Signal Co., Ltd.—A meeting is to be held at 1, Vine Street, Uxbridge, on November 27th, to hear an account of the winding up from the liquidator, Mr. A. T. Spear.

Aluminium Corporation (1907), Ltd.—A meeting is to be held at 60, London Wall, E.C., on December 6th, to hear an account of the winding up from the liquidators. This is not the 1909 company.

F. Woodfin & Co., electrical engineers, 138, Northgate Street, Chester.—Messrs. A. J. Williamson & F. Woodfin have dissolved partnership. Mr. Williamson will continue the business as Williamson & Co., at the same address.

Metallic-filament Lamps.—Price Reduction.—In addition to the firms mentioned in our last issue, we are informed that Messrs. Falk, Stadelmann & Co., Ltd., the "Z" Electric Lamp Manufacturing Co., Ltd., and Pope's Electric Lamp Co., Ltd., have made similar reductions in the prices of their metallic-filament lamps.

Electric Lighting at the Canadian Exhibition.—At the Canadian National Exhibition held at Toronto, a new installation was recently put in, and for the purposes of lighting its buildings 1,795 20-in. Benjamin reflector fittings were used, such as is illustrated below. These units, according to the *Canadian Electrical News*, have been run in series of six, so that low-voltage tungsten lamps may be used. The fittings consist of a deeply-hooded one-piece enamelled steel reflector and a specially designed lampholder. These reflectors are made in both distributing and concentrating types, and are for lamps from 25 to 500-watt sizes. The fittings were constructed with a separate fitting above the

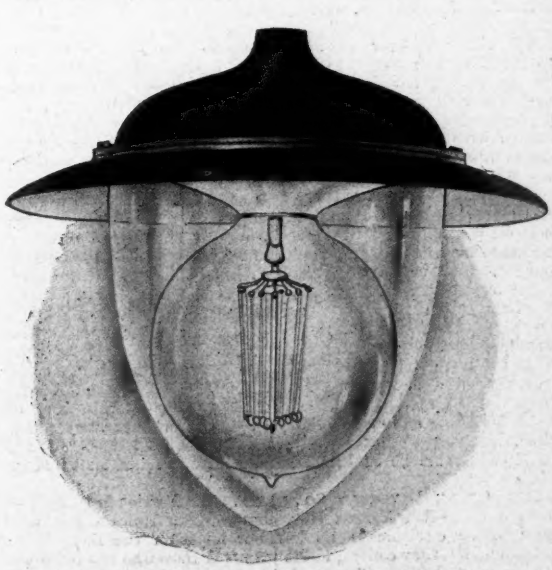


Canadian Exhibition Fitting.

reflector, so that they could be taken down after the exhibition and stored away until next year. Each reflector is designed for use with a definite range of lamps, and with particular regard for the correct relation of lamp filament and reflecting surface. The stage setting in front of the grand stand for the spectacle of the Coronation was illuminated by the means of these reflectors hung at a slight angle with the horizontal, so as to throw the light directly on the performers, and the illumination results are described as being most satisfactory. The Benjamin Electric, Ltd., of 117, Victoria Street, S.W., have issued a handy little booklet of 48 pages giving illustrations and prices of the complete range of their wireless clusters and cluster fittings.

Arc Lamp Patents.—In a circular letter issued by the Electrical Co., Ltd., it is stated that a rumour has got abroad that D.C. "Sunshine" flame arc lamps have infringed patents, and cannot be sold. This they state is not the case. An arrangement has been entered into with the owners of the master patent, and the Sunshine lamps are now sold under royalty, and do not infringe any patents. Forms of indemnity will be given whenever required.

Street Lighting Fittings.—In the accompanying figure we show a fitting (No. 58) designed and supplied by the Wardle Engineering Co., Ltd., of 196, Deansgate, Manchester, to meet the demand for a water-tight fitting for one high candle-power lamp. The top is of cast-iron; an internal convex zinc reflector is fitted, and is adjustable in height to suit various lamps. It is 24 in. diameter, and is finished in green and gold. Another new



Wardle Water-tight Fitting.

feature being placed on the market by this company is No. 53 "Beatark" type fitting, in which the globe is provided with a patent telescopic lowering device, by which it can be lowered to clean the lamps without detaching it from the fitting. It is a four-light (100 c.p. each) fitting 24 in. diameter, and is intended for street, yard and railway station lighting, and other such service. It is standardised to take four lamps around the centre, but No. 52 type is made to accommodate a centre 100-c.p. lamp as well.

The "Cole" Code.—The price of this code has been raised to 15s. net.

Electrical Trade in China.—A correspondent at Tientsin, in a recent letter to us, says:—"With regard to general electrical trade, I am afraid there is not a great deal doing in this part of the country, but we are all hoping for better times some day. Suction gas plants seem to have caught on very well in connection with press packing concerns, and about four sets have been, or are being, installed at the present time."

Book Notices.—*The Motor-Cycling Manual.* By the Staff of *Motor-Cycling*. London: Temple Press, Ltd. 1911. Price 1s. 6d. net.—The growing popularity of the motor-cycle has led to the issue of this work, a companion to the well-known manuals, and we have no doubt that very many of our readers will welcome it. Apart from the electrical ignition and the use of electric lamps, there is, of course, nothing electrical in the book, and what there is does not impress us with its accuracy. The explanation of the fundamental principles of the magneto, which is written in a "popular" style, is not free from errors—in particular, the illustration on page 29 shows the poles of the magneto short-circuited by a block of what appears to be cast-iron, for it is in one piece with the pole-pieces; and it is not true (page 33) that the primary current *increases* at the moment when the circuit is broken. On page 127 the reader is advised to use an amber-coloured lamp bulb in foggy weather, because it "has a much greater penetrative effect"—but the penetrative power resides in the rays of light, and can only be diminished, not increased, by the use of any tinted glass whatever. In discussing an epicyclic change-speed gear, the author says that the *number of the planet pinions* must be divisible exactly into the *numbers of teeth* of both the sun pinion and the drum—an absurd statement which shakes one's faith in the reliability of the work. However, in spite of such blemishes, the book undoubtedly contains a vast amount of useful information in a small space, including numerous practical hints obviously derived from experience on the road.

Boilers and Boiler Control. By J. B. C. Kershaw. London: Davis Bros. 1911. Price 1s. net.—This little book is an attempt to summarise the art of boiler control so far as regards the combustion of coal in an economical and smokeless manner, apart from any question of other matters of attendance. It is difficult to criticise such a book from the standpoint of its intended users, because the subjects of chemistry and physics are not yet as a rule familiar to the men on whom boiler attendance devolves. One recognises, of course, the value of high furnace temperature as a means of transmitting heat through plates, but here we run at once against one of the troubles of a boiler, for high furnace temperature cannot be employed when the plates are scaled or the water thick or muddy or colloidal. Boilers, of course, ought not to contain dirty or scale-forming water, but this brings up the whole question of water treatment and plate thicknesses and types of boiler, and would demand a much bigger volume than the one before us to treat it adequately. As regards grease in water, it is not generally known that if condensed engine discharge water is made to trickle through a filter of coke breeze a very large proportion of the grease will stick to the coke. Such a filter is easily replenished, and the greasy coke can be burned in the boiler furnace.

"Fortschritte der Elektrotechnik." By Dr. Karl Strecker. 1911. Berlin: Julius Springer. Price M15.

Catalogues and Lists.—Messrs. W. Mickelwright and Co., Sicilian House, Southampton Row, London, W.C.—Set of lists, in binding cover, describing, illustrating and giving prices of the following manufactures for cinematograph theatres and similar purposes:—Sliding contact type regulating resistances for small currents, small power motors, regulating resistances, plain resistances without regulation, knife switches, auto-converters and motor-generators.

Messrs. Drake & Gorham, Ltd., 66, Victoria Street, London, S.W.—New trade catalogue consisting of several hundred pages. It is conveniently divided up into a number of sections which are indicated by a thumb index. The first contains full illustrations and tabulated prices of various makes of incandescent lamps, metal and carbon filaments, battery lamps and heating lamps. The next deals similarly with arc lamps (flame, enclosed and photographic). The rest of the sections are these: cables and flexibles, switchboards and general accessories, heating and cooking apparatus, bells and telephones, auto-transformers, two-part insulators, fans, vacuum cleaners, and fittings. The last-named section is the largest of all, and it contains a great variety of fittings of all styles for inside and outside lighting, picture reflectors, advertising signs, Holophane glassware, ships' fittings, hand lamps, &c. The catalogue should be of considerable service to contractors and the trade.

The Globe Electric Co., Ltd., 11, Farringdon Avenue, London, E.C.—New list No. H81, containing a full description of their Globe electromagnetic hammer made on the Basic Rowe patents which they control in the principal European countries and the British Colonies. The tool is equally suitable for drilling, clipping and caulking purposes. The list gives prices.

Messrs. Perry & Grinsell, Ltd., 1 & 2, Leopold Street, Birmingham.—Leaflet giving illustrations and prices of their "P. and G." copper and tin electric kettles, also a couple of small and neat electric ovens, electric cooking plates and frying pans.

Mr. F. Patrick, 15, Oxford Street, Leeds.—Price list of small lathes and other tools, &c.

The Wright Electrical Sales Co., Ltd., Upper Mill Hill, Leeds.—Catalogue entitled "Something Electrical for Everybody," giving particulars and prices of a variety of electric bells and bell fittings, wires, motor-car accessories, pocket flash lamps, electric torches, dry batteries, portable battery lamps, battery electric fans, electro-medical coils, &c.

Allgemeine Elektricitats Gesellschaft, Berlin.—Pamphlets describing their arc-welding system and showing its application to large repair jobs; their compound controller for dock cranes; and tower signals for goods yards.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, London, S.W.—Very finely produced and well bound catalogue of over 100 pages (art paper). It is No. 527, Section I, and contains a fully illustrated and comprehensive account of the Morse telegraph apparatus manufactured by the firm. Accompanying it is a useful 24-page pamphlet containing instructions, with numerous diagrams, for using Morse station sets, single current, simplex and duplex, double current ditto and ditto, and quadruplex system. The contents of the catalogue include between 40 and 50 pages of illustrated descriptions of various Morse apparatus, about 30 pages dealing similarly with Morse station sets. The scheme on which the catalogue has been arranged is that the component parts of which telegraph station sets are made up are listed at the commencement, beginning with inkers and continuing with keys, sounders, galvanoscopes, relays, &c., to switches. After that are the station sets, the first section dealing with single current, which, in turn, is divided into simplex and duplex; the next with double current, which is also divided into simplex and duplex; and then follows the quadruplex system. The catalogue concludes with a few pages of accessories, diagrams of connections of station sets, and a comprehensive code and index. All the illustrations have been made from photographs of actual apparatus made at the firm's Woolwich Works, and, in many cases, there are offered not only Messrs. Siemens's own patterns, but those to the specification of the British Post Office. Every class of article is illustrated, and each item is provided with a clear specification, catalogue number and price, a point which will be appreciated by foreign buyers when ordering.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Booklet giving illustrations and particulars of their electric turret clocks (the patent "waiting train" system), including the very large clock at the Royal Liver Friendly Society's office at Liverpool.

The International Time Recording Co., 151-155, City Road, London, E.C.—Booklet of 80 pages giving a large number of half-tone views of their system of time recording in operation in a large number of works and offices in this and other countries.

The British Electric Calibrated Fuse Co., Luton, Beds.—New catalogue of the Weekes "Safetee" enclosed indicating fuse, standard terminals and clips, Pyrotin fuse wire and strip, &c. The company lay themselves out as "fuse specialists," and welcome inquiries for the solution of difficult fuse problems, such as are mentioned on the last page of the catalogue, in the course of a couple of letters reporting excellent results with "Safetee" fuses on public supplying circuits.

Magic Enterprise.—Not content with the display referred to in our last issue, Messrs. Magic Appliances organised a further attractive advertisement on Saturday last, the closing day of the Exhibition at Olympia. On this occasion there were three trim housemaids, each armed with a Magic suction cleaner, while two others, with dirty aprons, wielded the old-fashioned dust-pan and broom, thus bringing into sharp contrast the ancient and modern systems of cleaning. These clever and effective demonstrations deserve the reward which their originators will doubtless reap in the near future.

Trade Announcement.—The Electrical Co., Ltd., announce that Mr. W. G. Mayer is now with them, and has taken over the management of their "Plania" carbon business, for whose carbons and by-products they have been appointed sole agent for United Kingdom since September 30th, in place of Messrs. H. G. Mayer & Co.

Awards at Turin.—Messrs. Hans Renold, Ltd., have been awarded two Grand Prix for their display in the Engineering Section at the International Exhibition at Turin. In addition, they have been awarded two Grand Prix for their display in the Cycle and Motor Sections at the same Exhibition.

Messrs. Nalder Bros. & Thompson have been awarded the Grand Prix at the Turin Exhibition, where they are showing a very wide range of their well-known specialities.

LIGHTING and POWER NOTES.

Baildon.—The U.D.C. has appointed a Special Committee to investigate the unsatisfactory gas supply, and if failing to get satisfaction, to consider ways and means of providing facilities for electric supply.

Belfast.—The electrical engineer has presented a further report on the question of reduced charges for electricity, and has been instructed to have copies of same sent to each member of the Committee, the matter to be specially considered at the next meeting. Mr. Bloxam has also reported on tenders for switchboard extensions, and Mr. Bertram Thomas's, of Manchester, quoting £154, was accepted. Questions relating to the making of provision for increased facilities for storage of coals for use in cases of emergency at the electric station were discussed, and the engineer was instructed to submit a report thereon.

Biddulph.—The U.D.C. has engaged Messrs. Crewes and Handforth, of Manchester, to advise it respecting the E.L. scheme submitted by Mr. R. Heath, and to act as engineers if the scheme is adopted, at an inclusive fee of £5 per cent. The Council will apply for a prov. order if the scheme is to be carried out.

Blackpool.—The Tramways and Electricity Committee has had under consideration a report by Mr. C. Furness, the electrical engineer, in which it was pointed out that there was only a very small margin of reserve power in connection with the lighting and traction plants. Considering the loss in revenue and inconvenience which would follow a breakdown of any part of the present plant, the engineer suggested the desirability of having a complete steam turbo-alternator installed, at an estimated cost of £6,650. This, with £4,200 for additional traction plant, £350 for a cooling tower extension and £560 for contingencies, brought the suggested total expenditure under this head to £11,760. The Committee resolved that application be made to the L.G.B. for sanction to borrow £12,000 to enable the extensions to be carried out, and agreed that specifications be drafted and advertisements issued inviting tenders for the new plant.

Bradford.—The Electricity Committee of the T.C. has decided to extend the mains from Huddersfield Road along Cleckheaton Road and Park House Road, and to construct a transformer station, at an estimated cost of £1,935.

Brentford.—The Brentford Electric Supply Co. has recently entered into an agreement with the Metropolitan Electric Supply Co., Ltd., for a bulk supply and is now in a position to deal with all applications for a supply of electricity in the district. A large number of important contracts have already been secured. The registered offices of the company are now at 16, Stratford Place, Oxford Street, W., the secretary being Mr. E. Cunliffe Owen. The local office and showroom are at 3, The Broadway, Hanwell, and all communications respecting supply should be made to that address.

Brighton.—The T.C. has been recommended to rescind the resolution of August 28th, abolishing the existing charges for meter rents except in the case of consumers upon the maximum demand system, which would entail a loss of £1,200 a year. The Council is also recommended to fix a charge of 1d. per unit for current for power, heating and cooking at premises fitted with a lighting installation of not less than six 16-C.P. lamps.

A further recommendation favours the insertion, in any Bill promoted by the T.C., of powers to supply current in the Urban Districts of Portslade-by-Sea, Southwick and Shoreham-by-Sea, subject to the consent of the local authorities being obtained.

Burnham (Somerset).—The U.D.C. has decided not to relegate the powers for electric supply to a company, but to apply for its own prov. order.

Burton-on-Trent.—In order to encourage the use of electricity for heating purposes, the T.C. has instituted a rate of 1d. per unit for this purpose.

Chelmsford.—The electric light has been installed at St. Mary's Church, together with an electrical organ-blowing apparatus, at a cost of £370. The installation has been carried out by Messrs. Christy Bros., of Chelmsford.

China.—The extensive harbour works under way in South Manchuria, at Dalny, Port Arthur, Antung, Niuchwang and Hulutau will, according to the German Consul at Mukden, afford opportunity for the placing of considerable quantities of electric machinery and accessories.

Coatbridge.—Messrs. Wm. Bain & Co. have completed important modifications at their Lochrin Steel Works, including the substitution of an electric drive for a steam engine on the main rolling mill. Power for operating the mill is taken from the local supply company's mains, and is three-phase alternating current at 25 periods per second.

Continental Notes.—Turkey.—The production of electricity for distribution in Constantinople is effected by means of water-power. Surveys are now being made for utilising waterfalls situated near Sakana, in Asia Minor, where two stations will be established. The one above the falls will be served by the water impounded in a dam, giving a head of 53 m.; the second will make use of a head of 35 m. The power of the upper works will be 14,400 H.P.; that of the lower 7,650 H.P.—*La Revue Electrique.*

France.—A new company has recently been formed in Paris with a capital of £24,000 and the title La Société Electriques des Ilots de la Seine, Quartier Wagram.

The rural electrical installation at Valcanville-Barfleur shows, says the *Revue Electrique*, what can be obtained from between 15 and 20 H.P., and how much the metal-filament lamp facilitates the extension of the use of the electric light. The two-phase current generated is distributed at a pressure of 110 to 120 volts, the farmers in the rural districts being supplied at this pressure, or at 210 volts, and Valcanville, Montfarville and Barfleur at a higher pressure. The power at the falls is 13·5 KW.; that available at the terminals of the 210-volt alternators is 7·5 KW. An 8-H.P. petrol motor is used as an auxiliary. The transmission lines are of aluminium. To avoid limitation of the number of lamps used, current is sold at 105 francs per ampere-year, with a minimum of 75 francs for three lamps lit at the same time, the number being automatically controlled.

Spain.—An electric furnace on the Louviere-Louis system has been set up at the ironworks at Ayaya, in the province of Alava, where ferro-silicon has been produced from the slag of the puddle furnaces. It appears that two classes of ferro-silicon are produced—one of from 25 to 30 per cent., and the other of from 50 to 60 per cent., the consumption of energy for the former being 3,790 KW.-hours per ton with the use of coke, and 3,445 KW.-hours with the use of vegetable charcoal. To obtain ferro-silicon of from 50 to 60 per cent., the consumption of energy is 8,020 KW.-hours per ton with coke, and 7,105 KW.-hours with the use of vegetable carbon.

Russia.—Contracts have been sealed with the St. Petersburg electric lighting company to light certain streets and squares with 133 arc lamps for a period of five years, and several boulevards for a period of six years.

According to the *St. Petersburg Zeitung*, an electric railway, 140 km. long, is to be built by a company to Antrea, in the Viborg district, the current being generated at a station to be built on the River Imatra.

Doncaster.—The Corporation is contemplating applying for a provisional order enabling it to supply electricity to Wheatley, the fashionable quarter of the town.

Dublin.—The Electricity Supply Committee of the Corporation announces that it has organised an Electrical Exhibition of all classes of apparatus and fittings relating to the use of electricity for lighting, heating, cooking and power purposes, which will be held in the Mansion House from October 30th to November 4th. The Exhibition will be confined exclusively to manufacturers, and the exhibitors have agreed that no goods shall be sold in any section. Several gentlemen have accepted the invitation of the Committee to deliver short addresses in the evenings. On Monday, October 30th, Mr. Richard Cronin, chief locomotive engineer of the Dublin and South-Eastern Railway, will lecture on "Electricity in Home Decoration"; on Wednesday, Dr. Maurice Hayes, on "Electricity in Medicine and Surgery"; on Thursday, Mr. Ramsay MacNab, on "Electricity and Insurance"; on Friday, Mr. R. Borlase Matthews, M.I.E.E., on "Electric Cooking and Power in the Home," and again on Saturday on "The Comforts of Electric Lighting and Heating."

Eccles.—The electrical engineer has submitted a report with regard to the supply of electricity for lighting purposes to the houses of the Corporation in Corporation Road, for the year ended September 30th last. In his report he points out that 1,150 units were consumed which, charged at standard rates, realised an income of £14 17s. 11d. This amount had been paid over by the Health Committee to the electricity department, while the former had received from their tenants (at 6d. per week each) an income of £15 0s. 6d., therefore making a slight profit on the transaction. This result, the engineer states, which is a repetition of the satisfactory result obtained during the previous 12 months' supply, strongly demonstrated that the cost of electric light need be no obstacle to its general adoption in small houses. The cost of lamp renewals which were paid by the tenants worked out at 1s. 8¾d. each.

Erith.—The U.D.C. has applied to the L.G.B. for a loan of £7,671 for electricity purposes.

Exeter.—The E.L. Committee of the T.C. has decided to apply for a loan of £1,500 for new services.

Fareham.—The B. of G. has appointed a committee to consider the question of lighting the Workhouse by electricity.

Haslingden.—The electric light has been installed throughout the Haslingden Union Workhouse and offices, as the result of an agreement with the Rawtenstall Corporation, which is supplying the current. In switching on the light, Mrs. Mountain, the chairman of the board, expressed the hope that they would derive great benefit from the new means of illumination. She thought they would not be roasted or broiled or melted, as they had been sometimes by the heat from the gas-lights, in dark weather.

Heckmondwike.—The U.D.C. has decided to arrange with the Yorkshire Electric Power Co. for a supply of electricity in bulk.

Holmfirth.—A member of the U.D.C. has given notice to move, at the November meeting of the Council, that a prov. order for electric light be applied for, and a loan of £8,000 sought for carrying it out.

Houghton-le-Spring (Co. Durham).—The Education Sub-Committee has decided to obtain estimates for lighting Penshaw School with electricity.

Itchen.—The U.D.C. evidently seriously contemplates adopting electricity for lighting in the near future, as, notwithstanding the fact that the authority has ahead the prospect of having to proceed at once with a scheme in the event of a provisional order being issued, the Council has decided to take steps to ascertain the terms on which an engineering firm would advise on a scheme.

London.—Marylebone.—At the ordinary meeting of the B.C., on Thursday night, the adjourned report of the Electric Supply Committee was debated, the recommendation before the Council being that the statement of accounts for the year ending March 31st, 1911, be adopted. The first criticism levelled at the accounts was by Mr. Helsdon, who having objected to the way in which the two sets of accounts (one audited, and the other presented to the Joint Committee) differed in the apportionment of expenses, urged that the revenue accounts be referred back. Mr. A. J. Hopkins (Chairman of the Electric Supply Committee), in his answer, also dealt with some of the other charges which had been

made against the Committee. Having explained the reason of the difference in the two sets of accounts, and the necessity for certain adjustments when separating the Publicity and Sales Department accounts from the others, he said the explanation of the free use of current was this: that the Committee had felt it necessary some time back to get an independent opinion on the electrical cooking apparatus it was supplying, and on the uses and advantages of the method of cooking. Dr. Bokenham had consented to use one for the purposes of the test. The apparatus was lent to him, and that was the extent of the free use to "any privileged person." He was not aware of sundry consumers having a supply for nothing. But, in order to compete, with success, with the gas company, who were prepared to fix a consumer's house up for nothing, they (the Electricity Department) pushed the sale of current by loaning apparatus and doing wiring free. The result had been satisfactory. Another charge was that their man had gone into a house where a contractor's man was doing wiring, and tried to get an order for fittings. In that instance the wiring was being done by the contractor to the builders, who were working for the landlord, while their customer was only a tenant in the house. After giving figures to show that, compared with other London municipal and private undertakings, their electricity undertaking placed aside a proper and reasonable amount for the sinking fund, Mr. Hopkins urged that exceedingly good results were placed before them, and he was surprised that no note of appreciation had been sounded. The position of the undertaking, as compared with others in London and the provinces with outputs of over 10 million units a year, was good. Marylebone had the largest consumption of electricity per head of population of all but one place. The percentage of Marylebone was 87 units; the nearest below that was something like 60 units. Also their expenditure on working in comparison to their revenue had a much better showing than that of any of the other undertakings referred to, being about half of that of the highest. The recommendation was adopted.

The general manager of the electricity undertaking, and the station superintendent, reported that as a result of their recent visit to Germany, they were of opinion that there was a possibility of re-arranging the plates in the present battery cells, which would increase the capacity considerably. Thus, there was a good prospect of the Council's £27,000 battery scheme being deferred for some years. The manager is experimenting on the above lines, and is to report at a later date.

Hampstead.—The sanction of the L.C.C. has been asked by the B.C. to the borrowing of £15,000 for the conversion, throughout the area, of the present street gas lamps to electric lighting.

West Ham.—The Highways and Parks Committee has accepted an offer of the electricity department to install a 100-c.p. lamp on each traction standard on both sides of Prince Regent's Lane, at £2 11s. per lamp per annum.

The Legal and General Committee have had under consideration a list of matters for inclusion in the Bill which they proposed to promote in the next session of Parliament, which include the following:—(1) A recommendation from the Electric Lighting and Tramways Committee to the effect that a fixed-price-light scheme should be considered by the officers with a view to including a clause in the next Bill to obtain the power suggested by the electrical engineer; (2) To enable the Corporation to form a working balance for the undertaking, which subject was the cause of recent correspondence with the L.G.B. who would have granted a provisional order dealing with the matter on the condition that the Corporation should accept audits by the district auditor which were refused by the Council. If a clause for this purpose were to be inserted, the electrical engineer suggested that it should be wide enough to cover the undertaking generally, including the sales department, also to allow for the fixed-price-light scheme if adopted; (3) The question was raised by the engineer as to whether it would not be desirable in connection with the limited consent given by Wanstead as to the supply of electricity in their area to deal with the following matters:—(*a*) To ensure that the sales department powers are operative in the Wanstead area to be supplied; (*b*) to obtain powers to give supply in bulk to the Wanstead Council; (*c*) to supply public lighting in Wanstead; and (*d*) to erect any transformer chambers, sub-stations or any other buildings required in connection with the supply in Wanstead.

Stoke Newington.—In regard to the new agreement between the Council and the North Metropolitan Electric Power Supply Co., Ltd., for a bulk supply to the Council, Councillor Savery, chairman of the Electric Lighting Committee, explained that the new agreement would come into operation in March. There was a considerable profit on the electricity undertaking last year, and under the new agreement he believed that this would be considerably increased. Much difficulty had been experienced in making out the agreement, because the company stated that the Council were only using them as a stand-by, and there was a good deal of truth in this. The company finally came to an arrangement with the Council on the terms that it undertook to put a limitation on the plant, and the agreement would be for so long as the Council did not extend its generating plant. The company had required something in exchange for its reduction, and accordingly the contract period had been lengthened from 12 to 18 years.

Woolwich.—The Electricity Committee reports that under Sec. 29 (2) of the Council's Electric Lighting Order, the Council is required, on the expiration of the fifth complete financial year after the commencement of the supply under the Order, to reconsider and, if necessary, revise and thereafter maintain, the scale of prices charged for electrical energy under the Order, so that, so far as it is reasonably practicable, no rate will be required for the purpose of defraying the future expense of the undertaking during the next three years. The fifth complete financial year after the commencement of the supply expired in April last, and the Committee had had under consideration since that date the necessity of revising the scale of prices for the purposes set out in the clause referred to. It had considered from time to time for some years past the price charged to consumers as necessity arose, and had found it necessary to reduce same for the purposes of obtaining and retaining consumers. The result of the policy of the Council in thus reducing the charges had been to considerably increase the number of consumers, and to also increase the working profit on the undertaking from £1,108 in 1908 to £3,942 for the year ended March 31st last, the increase in this profit for the past year being nearly £1,050. This increase had taken place, in the Committee's opinion, in consequence of the reduction in the price of current. The Committee was satisfied that the only effect of an increase in the prices of energy supplied would be the loss of many consumers, with a consequent reduction in the revenue of the undertaking and the working profit therefrom, and a consequent substantially increased charge upon the rates, a result which would entirely frustrate the intention of the clause. It was, therefore, of opinion that for the purpose of the clause referred to, it was unnecessary at present to revise the scale of prices charged for energy and recommended accordingly. This was agreed to.

Newport (Mon.).—The B. of G. has decided to install an electric lift at the workhouse at a cost of £700.

Newton-le-Willows.—Messrs. Lacey & Sillar have been called in as consulting engineers to the U.D.C.

Penzance.—The T.C. has passed the plan of the electric supply scheme which is to be carried out under the 1904 Order by the Penzance and District Electric Supply Co., Ltd.

Salford.—The Electricity Committee has considered a report of Mr. C. D. Taite with reference to the generating plant at the Frederick Road electricity works, and has decided to adopt scheme "A" contained therein, which provides for the alteration of the existing engines and the provision of two turbo-generator sets, with necessary cables, switchgear, &c, at a total estimated cost of £35,000; further, to make application to the L.G.B. for the borrowing of £15,500 to cover the cost of two turbo-generator sets, &c. The work of altering the engines is to be carried out by Messrs. Browett, Lindley & Co. The Committee has also decided to enter into a three years' agreement with Mr. C. D. Taite for advising it in a consulting capacity, at a fee of £250 per annum, plus travelling expenses when absent on the Committee's business.

Sheffield.—The electric supply department is to be instructed to replace the present arc lamps in two of the bays of the Corn Exchange Hall with metal-filament lamps of 400 c.p., fitted with Holophane reflectors, and if these prove to be satisfactory, to extend same throughout the building, at an estimated cost of £29, otherwise to install 600-c.p. lamps instead of 400-c.p., at an estimated cost of £32.

Southend-on-Sea.—The T.C. has decided to engage a canvasser for the E.L. department for a term of six months, and to extend mains, when desirable, to the Thorpe Hall Estate, at a cost of £956.

Sowerby Bridge.—According to the *Halifax Weekly Courier*, Sowerby Bridge was in a state of gloom for part of last week, the local incandescent gas lamps in the streets and houses having practically given up business.

It is recorded that at a presentation ceremony at the Council offices the clerk found it necessary to strike a match in order to read the inscription on the gift, and almost a famine occurred in candles. Whatever may be the excuse for the gas shortage, and we feel sure our gas friends will find one, the Council has only itself to blame for not providing reliable street lighting, with an electric supply at hand.

Stockton Heath.—The P.C. has decided to ascertain what demand there is in the parish for electricity. The Salt Union offer to supply current.

Swanage.—The B. of T. has granted the Electric Supply Co. a final extension of time until June, 1912, for carrying out the electric light order granted in 1906.

Swansea.—The Markets Committee has decided to make the following charges to stall-holders for the supply of electricity: 25-c.p., 3½d. per week (single lamp, 4d.); 32-c.p., 4d.; 50-c.p., 5d.; 70-h.p., 7d.; 100-c.p., 9d.—Hefner c.p. in each case.

Ventnor.—The U.D.C. has accepted the tender of the Isle of Wight E.L. Co. for lighting the pier during the winter.

Winchester.—Owing to the electric supply undertaking having been acquired by the T.C., the electricity company is to be voluntarily wound up, the directors being paid £1,290, the amount of remuneration from 1897 to 1905, which was not paid, and the secretary and manager, Mr. Warburton, receiving £450 in lieu of notice.

Wolverhampton.—A L.G.B. inquiry will be held on October 31st into the application of the T.C. for a loan of £11,000 for the extension of the electricity buildings and plant.

Wombwell.—The U.D.C. has had the question of electric lighting under consideration, and decided to refuse the application of the Electrical Distribution of Yorkshire, Ltd., for consent to a proposed provisional order for a supply of electricity in the district.

TRAMWAY and RAILWAY NOTES.

Aberdare.—The U.D.C. has decided to proceed forthwith with the construction of the electric tramways.

Blackpool.—The tramways manager has obtained the sanction of his Committee to a revision of the scale of pay and hours of a number of tramwaymen, by which the wages of some will be increased, though none will be reduced.

Six new cars of the "toast-rack" type, so popular this season at Blackpool, are to be ordered in time for next Easter. Mr. Furness told his Committee on October 19th that he would like even more of these cars, but there was not sufficient housing accommodation for them.

This has been a record season in the history of the tramways. From April 1st to October 12th, the total receipts were £52,985, or £7,068 more than last year; 7¾ millions of passengers were carried, or 1,089,000 more than in 1910.

Continental Notes.—Germany.—It is stated that the Prussian Railway estimates for 1912 will include the first instalment for the conversion of the Berlin City and Circle Railways to electric traction. The preliminary works, which have now been finished, have convinced the Ministry of Finance that the transformation would have a beneficial effect upon the receipts of the railway. Trials with electric locomotives which are intended for the Berlin City Railway are at present being made at Bitterfeld.

The preliminary works of the 129 km.-long electric railway to Konigszelt, in Silesia, having been completed, the electric portion of the installation will now be taken in hand. The line is expected to cost 10 million marks. Three schemes having been sent in for the projected electric railway through the picturesque Taunus district of Hesse-Darmstadt, the authorities of the Homburg circuit have chosen that submitted by Herr August Scherl, of Berlin, being the gyro-mono-rail system, subject to the satisfactory results of the experimental working of a stretch of 5 km. which the tenderer will install. If the system answers expectations, a company will be floated for the construction of the line, which is to extend from Homburg to Kronberg.

Sweden.—The preliminary works are being actively pushed forward for the power station at Elfkarleby, 145 km. from Stockholm. The power, to the extent of 40,000 h.p., produced is to be used for the working of a railway near the capital and for the States Railways generally. Tenders for the equipment are being invited in our "Contracts Open" column.

Austria.—The dry summer and autumn have had, says *Der Elektrotechniker*, the effect of extraordinarily forwarding the construction of the great electric railway which is to run from Innsbruck in the Tyrol, through the Mittenwald to Karwendel, in Bavaria. Instead of being completed in 1913, as previously timed, the railway is expected to be out of the contractors' hands by October, 1912, Over 6,000 men are employed in the construction of the permanent way. Work at the numerous tunnels, viaducts and bridges has also made unusual progress. All the tunnels in the first section are completed, save the last begun—the Kerschbuch tunnel near Kranebitten—which will be finished in three months' time. In the longest tunnel of the whole line, the Martinswand tunnel (1,787 m. long) the metals are being laid, the tunnel the while being mechanically supplied with fresh air. The Isar viaduct near Scharnitz and the other viaducts in the stretch between Innsbruck and Scharnitz are finished all but one; the permanent way and overhead work of the bridges will be finished during the winter. Seven stations and watch-houses of the first section are roofed in. The completion of the first section will liberate the workmen for the second or Leermoos line, work on which will be actively prosecuted. The big Loisach viaduct, between Leermoos and Ehrwald, is almost finished, and the Klausen tunnel near Reutte is in hand, and other above-ground works are nearing completion. The generating station, which will supply current to the new line, the Ruetz station, will be erected to the south of Innsbruck near the Stephens bridge. It will supply current to both the Scharnitz and Leermoos lines until the Bavarian station on Lake Walchen is completed.

A preliminary concession has been granted to the municipal authorities of Brixen in respect of a projected electric tramway from that town to the summit of the Ploseberg.

Spain.—The Compañia de Ferrocarriles electricos en España is the style of a company formed in Almeria for the construction of an electric railway between that city and Granada. The preparation of the plans have been entrusted to Señor Cervantes, engineer-in-chief of the works of the Port of Almeria. The line will traverse a most picturesque country, including the celebrated Sierra Nevada, and serve some 32 towns and villages.

Belgium.—La Société des Tramways Vervietois has just secured a concession for the extension of the Verviers-Ensival electric tramway as far as Pepinster.

France.—The Board of Bridges and Roads of the department of the Muerthe et Moselle has applied to the Government for sanction to the installation of electric haulage in the Tunnel de Fourg and for 5 km. along its course. The feasibility of its employment has already been demonstrated by experiments carried out at the Ecluse de Jarville by the Compagnie Générale Electrique. The current will be supplied by the Compagnie Lorraine d'Electricité.—*Revue Electrique.*

Dewsbury.—Considerable extensions of the electric tramway system are being made by the Corporation. A prov. order has been confirmed by Parliament for the construction of a line from Dewsbury Market Place to the suburb of Shaw Cross, and negotiations are to be entered into with the National Electric Construction Co., Ltd., for the construction, working, &c., of the tramways. The Dewsbury to Ossett cars are already being run by that company. The Corporation has also decided to apply for a prov. order for the construction of tramways from the junction of Halifax Road and Willans Road to the boundary of the borough at Dewsbury Moor, and it is sought to make an arrangement with the Borough of Batley for running powers in a portion of that town, so that the proposed tramways can be connected up to those to Heckmondwike. On account of the heavy gradients in the Dewsbury Moor district, which it is expected will be rapidly developed when an efficient service of cars is established, proposals for the adoption of the railless trolley system has been rejected as impracticable. The British Electric Traction Co. allowed its powers with respect to Dewsbury Moor to lapse, as it did not think the amount of traffic would, for a considerable period, give an adequate return for the necessary heavy capital outlay.

Edinburgh.—The proposal to adopt railless traction and the suggested routes have been discussed at a conference between a Sub-Committee of the Corporation Tramway Committee and the directors of the tramway company. It is stated that the meeting revealed a satisfactory attitude on the part of the company towards the new system. A deputation from Leith T.C. had an interview with the Edinburgh Sub-Committee regarding the proposals in Leith for tramway extension. Although no definite decision was arrived at, it is expected that the railless trolley system will be so arranged, so far as routes are concerned, as to meet the case of Leith.

Glasgow.—The members and officials of the Tramways Committee who went over English and Continental works to select additional turbine plant for the Pinkston power station, have issued a report, in which they state that they had had considerable difficulty in deciding from among the many excellent makers which firm they should recommend, there being very little in the question of price; indeed, this was a contract in which the question of cost did not enter very largely. In making a selection they had been largely influenced by the three features previously referred to in this report:—(1) The Curtis wheel at the high-pressure end; (2) the governor gear; (3) the blading. With these three points before them they had come to the conclusion that the turbines which correspond to their standard were the impulse turbine, which was offered by the British Thomson-Houston Co., of Rugby, and the impulse-reaction type, which was offered by Messrs. Richardsons, Westgarth & Co., of West Hartlepool. Another very important element in regard to the whole question of the installation of turbines which was brought very forcibly under their notice was the almost entire disuse of reciprocating plant. In many stations comparatively new engines were standing idle, the whole load being taken by the turbine sets. Municipal authorities and private companies were, apparently, finding it advantageous to install turbines and simply keep their reciprocating sets for use in emergencies. This was exactly their position at Pinkston. They, therefore, strongly recommended the purchase of two turbine sets at this time instead of one, so that the whole load might be taken up by the turbines. They were convinced that such a course would prove very advantageous to the department. The Committee thought it advisable to take this course, they recommended that one turbine of the pure impulse type, with the alternator, be purchased from the British Thomson-Houston Co., and another turbine of the impulse-reaction type, with a Brown-Boveri alternator, be purchased from Messrs. Richardsons, Westgarth & Co. They would then have at Pinkston a pure reaction turbine, a pure impulse turbine, and an impulse-reaction turbine, and their experience with these various types would prove of great service to the Corporation in the event of any extensive scheme being proposed for the installation of more power plant. The parent Committee has approved this. A special Committee is to report on the advisability of making an experiment over the tramway system of the proposed granting of two of the present ½d. stages for one ½d.

Hove.—The Brighton Corporation has written the Council to the effect that it has under consideration the question of providing a system of railless electric traction in the borough, and asking the Hove Corporation to co-operate with it in an application to Parliament for powers to construct and work a joint system which would meet the traffic requirements of the two towns. The General Purposes Committee, after receiving a deputation from the Brighton Council, decided to promote its own Bill for a trolley vehicle system within the boundaries of the borough of Hove.

Leeds.—The Tramways Committee on Monday decided to double the tramway lines on several routes where there is at present only a single track. The work is expected to cost about £10,000.

Mossley.—Early on the day of our last issue another unfortunate tramway accident occurred to a workmen's car on the Stalybridge Joint Board's system. The car—a single-decker—apparently got out of hand on a steep hill near Mossley station, left the track at a curve, and after running through a walled garden, fell into a railway cutting, four persons being killed outright, while two others have since died. A Board of Trade inquiry was opened on Tuesday, when Col. Von Donop inquired into the circumstances of the accident. The evidence of passengers and eye-witnesses was taken, but no material facts as to the cause of the disaster were elicited, and the inquiry was finally adjourned until the driver of the ill-fated car is able to give evidence.

Newcastle-on-Tyne.—At a meeting of the City Council, on the 20th inst., the Tramways Committee submitted a report on the proposed works, powers for which had been obtained in the

Corporation's recent Bill. The Committee recommended that the works be carried out by labour employed directly by the Corporation, with, perhaps, the exception of some of the street works at Newburn, which it might be desirable for the local Urban Council to execute. With regard to the extension of the system to Newburn, negotiations were proceeding in regard to acquisition of land, alteration of waggon-ways, &c., and the Committee recommended that that portion of the work be not commenced until next spring. As to tramway No. 2 (between New Bridge Street and Jesmond Road), the Committee recommended that this be started as soon as the preparation of materials permitted; the rails were in stock. Benton Bank was to be raised, but, except this portion, the whole of the work in connection with this section would be proceeded with. In connection with this work a portion, where the gradient was steep, would require heavier rails than those in stock. The Chillingham Road section was to be proceeded with as soon as material was prepared; for this rails in stock would be used. The report was adopted practically without discussion.

Oxford.—The T.C. on Monday decided not to adopt an overhead system for the proposed tramways.

Railway Electrical Developments.—The *Daily Express* understands that the L. & N.W. and G.C. Railways are experimenting with self-contained electric locomotives, and adds that these will be of the petrol-electric type; the *Standard*, dealing with same subject, says a leading British railway has given instructions for the preparation of designs for a Diesel electric locomotive of 500 H.P., and mentions that the results obtained with the Scottish turbo-electric locomotive have not come up to expectations. These developments are interesting, but contrary to the views expressed by the above papers, any form of self-contained locomotive is at best a makeshift on routes which, on account of heavy traffic conditions, are suited to ordinary electric traction.

Salford.—The town clerk reports with regard to the appeals to Quarter Sessions of the Corporation against the assessment of the Corporation by the Barton-upon-Irwell Union Assessment Committee, in respect of the use by the Corporation of the Eccles tramways and the Swinton township tramways, that these have been satisfactorily settled by him with the solicitors of the Union, as follows:—The assessment in Eccles reduced from £2,434 to £262; and the assessment in Swinton reduced from £1,002 to £75, thus making a net saving of rates levied in the past three years of £3,252.

Sheffield.—The Corporation has decided to double the tramway track at the city end of Ecclesall Road.

West Ham.—The Electric Lighting and Tramways Committee has had under consideration the provisions to be made in the proposed Bill in Parliament for the construction of a tramway across Wanstead Flats, and its continuation to "The Green Man." A report from the borough engineer states that the estimated cost of constructing a double line of tramway from the Council's tramway terminus along Woodford Road, Blake Hall Road and Bush Road to "The Green Man" terminus of the Leyton Council's tramways would be approximately £19,000. The estimated cost of the overhead equipment would be about £1,500, the cost of widening Woodford Road from the Forest Gate terminus to Aldersbrook Road to 50 ft. would be approximately £8,000, and the cost of maintenance of the widened roadway, exclusive of the tramway, but including lighting the road with arc lamps, would be about £600 per annum. The Committee recommended that provision be made in the Bill for the construction of a double line of tramway from Forest Gate to "Green Man," expressing the opinion that as no widenings were necessary for tramway purposes, the Bill should not include a provision therefor. Should, however, the Council determine to carry out the widenings apart from tramways, it considered that the £8,000 estimated outlay and £600 estimated cost of maintenance should not form a charge against the tramway undertaking.

TELEGRAPH and TELEPHONE NOTES.

A Trieste - Alexandria Cable.—It is reported from Vienna that a company is to be formed under the lead of the Austrian Felten & Guilleaume Co. for the establishment and working of a cable between Trieste and Alexandria. The capital is to be £416,000.

Anglo-Continental Telephone Service.—As the result of the test calls mentioned in our last issue, a telephonic service between subscribers in Inner London and in Geneva and Basle will be inaugurated when the necessary arrangements between the two Administrations are completed.

Automatic Register.—It is reported that a Mr. E. G. Godfree, of the Victorian Railway Department, has devised an automatic registering device for telephone calls, which is operated by the removal of the receivers from the hooks of two subscribers when put into communication. The device is intended for use with the C.B. system.

Falmouth.—A situation has arisen at Falmouth similar to that at Hythe; the owner of a garden across which 50 overhead wires are carried has objected to their presence, and as the National Telephone Co., in view of the coming expiry of the licence, will not undertake the expense of substituting a cable, it was last week announced that unless the objection were withdrawn, the wires would be removed, isolating the town.

Hythe.—While the Corporation arrived at an agreement with the Post Office regarding the substitution of underground for overhead wires in the Mayor's Avenue, the National Telephone Co. appears to have been no party to this settlement, and on Wednesday this week, if terms were not previously arranged, the company was to have removed the wires, leaving the town isolated from telephonic communication with other centres. A subscriber, however, applied for an injunction to prevent the company from cutting off the service, and no action will be taken until this has been disposed of.

Melbourne.—The new central-battery exchange was brought into use at the end of August, 3,000 subscribers being transferred from the old "City" exchange. The Wills Street exchange subscribers were afterwards changed over to the new exchange, to the number of 4,000. The undergrounding of the lines, however, will not be completed for another year, and until this is accomplished the full benefit of the new equipment cannot be obtained.

Russia.—According to Russian newspapers, the question of a telephone connection between St. Petersburg and Berlin is under the consideration of the Russian Post and Telegraph Administration, as a consequence of the offer of a large Russian electrotechnical firm to build the line. The estimated cost is put at 10,000,000 roubles.

The Russian Administration of Posts and Telegraphs has applied for powers to lay an additional telephone line between Moscow and St. Petersburg. The cost of the work is estimated at £21,100. —*Board of Trade Journal.*

Spitzbergen.—The trials made at the wireless station recently established at Spitzbergen have yielded favourable results, and actual working is to begin in the near future. It is stated that the station is able to receive radiograms from Norddeich and Poldhu, and that this guarantees the certainty of the connection with Ingoe, in Norway. The latter station is to take up the main service with Spitzbergen, and is to be completed in the middle of November.

Sydney.—As the result of his investigations, the Special Commissioner, Mr. H. W. Ramsay-Sharp, appointed to test the Sydney and suburban telephone system, has submitted a lengthy report to the Chamber of Commerce. He makes a number of recommendations for the improvement of the service, and comments on the "stupendous task that confronts the telephone officials before the present system can be brought up-to-date and the result of past neglect wiped out."

Wireless Telegraph Patents.—An agreement has been arrived at between Marconi's Wireless Telegraph Co., Ltd., and the Lodge-Muirhead Wireless and General Telegraphy Syndicate, whereby all disputes regarding their respective patent rights are ended; the former company takes over all the Lodge-Muirhead patents, and Sir Oliver Lodge will in future act as a scientific adviser to the Marconi Co. On the other hand, the Marconi Co. has taken steps against Messrs. Siemens Bros. & Co., Ltd., on the score of an alleged infringement of its patents.

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—October 28th. Gas-raising and by-product recovery plant, one 1000-H.P. gas engine, and one 750-KW. E.H.T. generator, for the Corporation. See "Official Notices" October 13th.

Australia.—WESTERN AUSTRALIA.—November 21st. One automatic or semi-automatic switchboard and equipment, for the P.M.G.'s Department. See "Official Notices" September 15th.

November 29th.—One portable hand-driven desiccating plant, and binders, sleeves, tapes and copper wire, for the P.M.G.'s Department. See "Official Notices" October 13th.

NEW SOUTH WALES.—December 20th. One branching multiple magneto switchboard at Broken Hill, for the P.M.G.'s Department. See "Official Notices" September 22nd.

November 15th.—Telephone cords and ear-pieces, for the P.M.G.'s Department. See "Official Notices" September 29th.

November 15th.—Magneto switchboards, &c., for the P.M.G. See "Official Notices" October 6th.

November 22nd.—Cable for the P.M.G.'s Department. See "Official Notices" September 29th.

VICTORIA.—November 28th. Ebonite earpieces, calculagraphs, and insulators for the P.M.G. See "Official Notices" October 6th.

December 12th.—Ebonite earpieces, telephone cords, bronze and copper wire, Bleeck-Love cells and charges, and telephone material, for the P.M.G.'s Department. See "Official Notices" October 20th.

TASMANIA.—December 11th. Four nauts of india-rubber-insulated submarine telegraph cable (Schedule No. 33), for the Deputy Postmaster-General Hobart. Specifications and forms of tender from the High Commissioner in London for the Commonwealth of Australia, 72, Victoria Street, S.W. Copies of the specifications may be seen by British makers at the Commercial Intelligence Branch of the Board of Trade.—*Board of Trade Journal.*

Belgium.—November 15th. La Société Nationale des Chemins de Fer Vicinaux, of 14, Rue de la Science, Brussels, is inviting tenders for the supply and erection of the overhead electrical equipment of the light electric railways in the Malines district.

Canada.—Lethbridge.—November 24th. Municipality. Power station equipment, comprising boilers, economiser, steam turbo-generator, condenser and sub-station equipment; 10 per cent. deposit with tender. Plans, &c., from A. Reid, superintendent engineer, Lethbridge.

Dublin.—November 9th. The Corporation is inviting tenders for electrically-driven centrifugal pumps for the Ringsend pumping station.

November 6th.—General stores for a year, for the Dublin United Tramways Co., Ltd. See "Official Notices" October 13th.

Edinburgh.—The Corporation invites tenders for the electrical installation for lighting, heating and power at the College of Art. F. A. Newington, Corporation electrical engineer.

France.—November 4th. The Under-Secretary of State of Posts and Telegraphs in Paris (103, Rue de Grenelle) is inviting tenders for the supply of five lots of gutta-percha and cotton-covered copper wire.

Great Western Railway.—November 7th. Stores for a year. See "Official Notices" October 6th.

London.—L.C.C.—November 6th. Stores for a year. See "Official Notices" October 20th.

Radcliffe.—November 7th. Two 300-kw. rotary converters and transformers, and E.H.T. switchgear for the U.D.C. See "Official Notices" October 20th.

Sheffield.—November 13th. One 5,500-kw. steam turbine, condensing plant, pumps, pipework, &c., and alternator and exciter, for the Corporation. See "Official Notices" October 13th.

Siam.—December 30th. Tenders are invited for five electrically-driven centrifugal pumps for the waterworks at Bangkok. Particulars, Local Sanitary Department, Bangkok.

South Africa.—Cape Town.—The Municipal Councils of Claremont, Rondebosch and Mowbray are inviting tenders for electric lighting of roads and thoroughfares, and for a public supply to private consumers. Particulars from the Town Clerks of Claremont and Rondebosch.

Spain.—The municipal authorities of Torquemradi (province of Palencia) have just invited tenders for the concession for the electric lighting of the town during a period of eight years.

Tenders have lately been invited by the municipal authorities of Santa Perpetua de Moguda (province of Barcelona) for the concession for the electric lighting of the town during a period of 10 years.

Uruguay.—February 6th, 1912. Tenders are invited by the Port Authorities at Monte Video for the supply of 13 electric cranes, together with 600 metres of steel rails. Tenders, accompanied with a deposit of 1,000 pesos (about £212), to the "Secretaria del Consejo de Administración del Puerto de Monte Video," Monte Video. Proofs of technical ability are required from tenderers. A copy of the specification (in Spanish) may be seen by British manufacturers at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C. Local representation is advisable. A list of agents established at Monte Video may be obtained by British firms at the Commercial Intelligence Branch.—*Board of Trade Journal.*

CLOSED.

Accrington.—The Electricity Committee has considered tenders for switchgear required for the sub-station in connection with the high-tension supply to Globe Works. That submitted by Messrs. Ferranti, Ltd., at a cost of £143, was accepted, on October 19th. Tenders were submitted for the supply of one 300-K.V.A. three-phase transformer in connection with the same supply, and the one submitted by the British Westinghouse Co., Ltd., at £180, was accepted.

Australia.—The following contracts have been placed by the Commonwealth, according to the *Australian Mining Standard*:—

New South Wales.—Department of Home Affairs.—Electric lifts and cranes at Darling Island naval stores, Sydney, £6,000.—Standard Waygood Co.

Victoria.—Postmaster-General's Department.—150 miles of copper wire, £473.—Siemens Bros. Dynamo Works (Sydney), Ltd.

150 miles of tinned-copper wire, £1,226 5s.—Callender's Cable and Construction Co., Ltd.

1,400 protectors, £198.—British Insulated and Helsby Cables, Ltd.

Stay rods, £827.—Victoria Rolling Mills Co. Pty., Ltd.

Switchboard for Bendigo P.O., £3,877.—Western Elec. Co. (Australia), Ltd.

Supply of sulphate of copper to all States, £5,185 15s.—Wallaroo and Moonta Mining and Smelting Co., Ltd.

The *Australian Mining Standard* also states that the order of the Mortlake Butter and Cheese Factory (Victoria) for the supply of wires, dynamos and plant, in connection with the electric supply scheme, has been placed with the Silvertown Rubber Co., at £1,119.

Bradford.—The Works Sub-Committee of the Tramways Committee has accepted a tender of Messrs. Cammell, Laird and Co., Ltd., for 200 steel tires for tramcar wheels, at £342 10s.

Bristol.—The Docks Committee of the T.C. on Monday accepted the tender of Messrs. Johnson & Phillips, Ltd., for cables for the new cold stores.

Faversham.—The T.C. has accepted the tender of Messrs. S. Davis for 250 tons of anthracite coal for the electricity works, at £1 13s. 9d. per ton.

Government.—The following tenders have been accepted during the past month by the Government departments named:—

Admiralty, Contract Department.

Dry cells.—J. C. Fuller & Son.

India Office, Store Department.

Cables.—Siemens Bros. & Co.
Calls.—Tudor Accumulator Co.
Insulator cups.—Bullers, Ltd.; Taylor, Tunnicliff & Co.
Switchboards.—Johnson & Phillips, Ltd.
Telephone apparatus.—Western Electric Co.
Terminal sets.—British L. M. Ericsson Manufacturing Co.

General Post Office.

Automatic telephone exchange equipment (Epsom Post Office).—British Insulated and Helsby Cables, Ltd.
Ditto for Caterham Valley Post Office.—The American Machine Telephone Co., Ltd., per J. H. Tennant.
Electric lifts (Belfast P.O.).—John McLean & Sons.
Ditto (S.E. District P.O., London).—Medway's Safety Lift Co.
Electric lighting (Newcastle-on-Tyne P.O.).—Falconar Cross & Co.
Telegraphic apparatus, perforators, keyboards.—Gell Teleg. Appliances Syndicate, Ltd.
Telephonic apparatus, bell sets and retardation coils.—Western Electric Co., Ltd.
Flexible cords.—British Insulated and Helsby Cables, Ltd., and London Electric Wire Co., and Smiths, Ltd.
Jacks.—British L. M. Ericsson Manufacturing Co., Ltd.
Bell receivers.—Siemens Bros. & Co., Ltd.
Telephones.—British L. M. Ericsson Manufacturing Co., Ltd.; Peel-Conner Telegraph Works, Ltd.; Sterling Telegraph and Electric Works, Ltd.; Walter's Electrical Manufacturing Co., Ltd.
I.R. and C.C. cable.—Henley's Telegraph Works Co., Ltd.
Paper core cable.—British Insulated and Helsby Cables, Ltd.; Siemens Bros. & Co., Ltd.
Switchboard cable.—London Electric Wire Co. and Smiths, Ltd.; Western Electric Co., Ltd.

Hastings.—At the last meeting of the Board of Guardians tenders were received for wiring the workhouse premises, the Corporation having agreed to extend their mains to that institution. The Board, acting on the advice of Mr. R. Ferguson, the borough electrical engineer, invited tenders on two separate schedules—one for the capping-and-casing system, and the other for Stannos wire or O.S. system. Tenders were opened as follows:—

	Capping and casing.	Stannos wire.
Edmundson Co., London	£1,026	£985
Harland, Bowden & Co., London	755	—
Bance & Co., Hastings	775	—
Taylor & Co., London	870	—
Sherland Bros., Birmingham	535	500
Tredegar & Co., Westminster	412	348
Gailliers, Brighton	610	705
A. H. Wood, Hastings	707	—
Small & Walton, London	929	985
Newbald, Sutton	758	775
Banbury Electrical Co.	600	—
F. G. Petitt, Hastings	672	785
Fryer & Co., London	1,255	—
Price & Co., Cardiff	401	380
Tilley Bros., London	570	595
Besant, Eastbourne	760	765
Hancock & Rickson, London	568	490
Weston, London	608	690
Reed & Sons, Brighton	695	687

In reply to a question, it was stated that the engineer's estimate was £468. Debate ensued as to the two systems, and it appeared that it was Mr. Ferguson's opinion that for a workhouse the Stannos system was quite as good as the other, and that it would be cheaper and more easily fixed. The Chairman moved that the tender of Messrs. Tredegar & Co. for the Stannos system be accepted. Councillor Hill seconded. Mr. Kelly thought the matter should be referred to the Committee for inquiry as to Tredegar & Co. and the next lowest tenderer. The Clerk explained that Tredegar & Co. had carried out big jobs in various parts, including Waterloo Station. The tender of Messrs. Tredegar & Co. was thereupon accepted.

London.—Southwark.—The B.C. has accepted the tender of Messrs. Alfred Blackmore & Co., Ltd., for the supply of 7,000 tons of various kinds of coal; half the quantity at 11s. 8d. per ton and the remaining half at 11s. 3d. per ton.

L.C.C.—The Education Committee received the following tenders for the electric lighting of the Great College Street School, St. Pancras, E.:—

Saville & Walton	£340
G. Weston & Sons, Ltd.	(accepted) 395
T. H. Smerdon	412
Johnson & Phillips	455
Tredegar & Co.	465
Williams & Bach	484
Waring & Withers	497
E. Lawrence & Sons, Ltd.	525
Fleet Electrical Co.	567

In pursuance of the authority delegated to the vice-chairman of the Buildings Sub-Committee, the lowest tender for the electric lighting work—viz., that of Saville & Walton, amounting to £340, was accepted, and the work was ordered without waiting for the formal completion of the contract. "After a short time, however, the men and the material delivered were withdrawn from the school, the contractors stating that they did not intend to proceed with the contract. Having regard to the necessity for the work being put in hand without delay, our chairman accepted the next tender, that of G. Weston & Sons, Ltd., amounting to £395, and authorised the commencement of the work without waiting for the formal completion of the contract. . . . We are of opinion that the name of Messrs. Saville & Walton should be entered on the list

of persons and firms from whom the Council will not accept tenders."

The Highways Committee has accepted the tender of Hadfield's Steel Foundry Co., Ltd., for single and double junction lines for tramways in South London, at £2,815.

Five tenders were received for sand drying and crushing plant for the permanent-way depôts, but as none was regarded as satisfactory, none is to be accepted.

The Highways Committee accepted the following tenders for rails for new car-sheds and the central car-repair depôt :—

Bolckow, Vaughan & Co., Ltd.—300 tons of No. 60 rails ..	£6	7	0
18 tons of fishplates ..	8	7	0
P. & W. Maclellan, Ltd.—15 tons of No. 25 rails	7	10	6
½ ton of fishplates	8	18	0
Cammell, Laird & Co., Ltd.—2½ tons bolts and nuts (No. 60) ..	14	10	0
P. & W. Maclellan, Ltd.—½ ton bolts and nuts (No. 25)	19	0	0
Bolckow, Vaughan & Co., Ltd.—500 fishplates (to sketches) ..	9	12	0

None of the tenders for punching and shearing and other machines at the Stockwell depôt was satisfactory, and fresh ones will be invited later.

HACKNEY.—The B.C. Electricity Committee received the following tenders for the supply of white open type arc lamp carbons, the prices being per 1,000 pairs :—

	"A.B." quality.	"C.D." quality.
Siemens Bros. Dynamo Works, Ltd.	£5 8 0	£4 10 5
W. Geipel & Co.—H. 201	3 4 3	2 18 9
H. 202	3 18 7	3 2 5
Sloan Electrical Co., Ltd.	3 1 3	2 11 3
Brush Electrical Co., Ltd.	3 13 8	3 1 4
Ship Carbons, Ltd.	3 6 11	2 15 10
Crompton & Co., Ltd.	3 16 0	3 3 6

The tender of the Sloan Electrical Co. is the lowest and is for "C" quality Conradty carbons which have been used by the department before and found satisfactory, therefore their tender for the supply of 100,000 pairs of white open type arc lamp carbons at £2 11s. 3d. per 1,000 pairs is recommended for acceptance, subject to the Borough Electrical Engineer's tests upon the samples submitted proving satisfactory.

Salisbury.—The following is a list of tenders received by the Salisbury and District Joint Isolation Hospital for the electric light and power installation (architect, Mr. J. H. Goodman, Reading) :—

Cozens, S. G., London	£1,267
Edmundson's Electricity Corporation, Ltd., London ..	1,394
Edwards & Armstrong, Bristol	1,020
Electrical & Motor Co., Banbury	1,266
Ellis & Ward, Ltd., Birmingham	1,188
Felgate Installation Co., Ltd., Reading	1,176
Giffen Bros., St. Albans	1,160
Graham Bros., Middlesbrough	1,091
Grossmith & Co., Southsea .. .. .. (accepted)	998
Hancock & Rixon, London	1,093
Innes, Albert, Leeds	1,221
Johnson & Phillips, Ltd., Charlton	1,169
Lea, Son & Co., Shrewsbury	1,220
Malcolm & Allan, Ltd., London	1,406
Mann, Egerton & Co., Ltd., London	1,374
Mansfield Engineering Co., Mansfield	1,114
Price, Fred., & Co., Ltd., Cardiff	1,025
Saville & Walton, London	1,309
Vaughan, T. W., & Co., Ltd., London	1,320
Wallsall Electrical Co., Ltd., Walsall	1,390
Wilkins, Fred., & Brother, Ltd., Liverpool	1,093

Weston-super-Mare.—The U.D.C. has accepted the tender of Weston and District Electric Supply Co., Ltd., for a motor and starter for the depôt, at £52 10s.

Worthing.—The T.C., on the recommendation of the resident engineer, has accepted the following additional tenders in connection with the installation of the new Diesel engine plant at the Corporation generating station :—

Fuel oil tank.—Messrs. J. J. Whittaker & Co., £39.
Fuel oil measuring tank and meter, £18, and ammeters and automatic circuit-breakers, £24.—Messrs. F. A. Greene & Co.
Combination generator switches and bus-bars.—Messrs. J. Fowler & Co., Ltd., £27.

FORTHCOMING EVENTS.

Physical Society.—Friday, October 27th. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "Further Observations on the Afterglow of Electric Discharge and Kindred Phenomena," by the Hon. R. J. Strutt; and "Homogeneous Fluorescent X-Radiation of a Second Series," by Prof. C. G. Barkla and Mr. J. Nicol.

Institution of Electrical Engineers (Manchester Local Section).—Friday, October 27th. At 7.30 p.m. At the University, Manchester. Address by Mr. W. Cramp.

Association of Engineers-in-Charge.—Saturday, October 28th. At 6.30 p.m. At Liverpool Street Hotel. Social. Ladies' night.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, October 31st. At 7.30 p.m. At the Manchester School of Technology. Opening meeting. Address by Mr. J. F. C. Snell.

Electrical Treatment of Milk.—A report has appeared in the *Daily Express* regarding a system of electrical treatment of milk and other liquids, whereby they are successfully sterilised and purified. The process is the invention of Mr. Douglas L. V. Browne, of 38, Rue des Perchamps, Auteuil, Paris, but no information is given as regards his *modus operandi*.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Col. H. M. Leap.

The following orders are issued :—

Wednesday, November 1st.—N.C.O.'s mess meeting at 8 p.m.
Thursday, November 2nd.—"C" Company. 7 p.m., lecture. 8 to 10 p.m., technical work and infantry drill.
Friday, November 3rd.—"D" Company.—7 p.m., lecture. 8 to 10 p.m., technical work and infantry drill.
Saturday, November 4th.—Headquarters will be opened for Regimental business from 10 a.m. to 12 noon.

(Signed) P. H. Campbell, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

NOTES.

Sweating Skilled Labour.—A correspondent, who inquired after an appointment in the Midlands as "meter tester and testing assistant," has sent us the following schedule of qualifications required of candidates for the post :—The candidate must be not less than 19 years old, and must have successfully passed through a complete course of theoretical and practical training in a recognised technical school or college, gained a certificate or diploma, and have had some experience in a works of good standing. He must be thoroughly experienced in testing and adjusting meters, indicators, and apparatus of all types and makes; capable of using potentiometers and standard instruments, and of calibrating, checking and maintaining accurate all the electrical apparatus in the works; and able to localise faults on mains and to test insulation during working, besides investigating complaints. He must be ready to assist the mains superintendent in technical matters, and act for him in his absence, and must be a fair draughtsman, quick at figures, and able to use logs and the slide rule. Moreover, besides taking charge of the test-room and maintaining its contents accurate and in good order, he will be required to show a thorough knowledge of all branches of D.C. and A.C. testing, and must possess sufficient mechanical knowledge and skill to repair instruments and meters.

To comply with all the requirements demanded, the candidate would have to be more like 29 than 19 years old. Yet the "salary" offered for this compendium of mechanical, electrical, mathematical, experimental, technical and scientific excellences, is no more than 26s. a week—about 4s. 6d. a day—less than the pay of a day-labourer or a charwoman!

If this is not sweating, what is?

Electrical Openings in Servia.—As a market for electrical machinery and apparatus Servia affords, according to the German Consul at Belgrade, a noteworthy opening. In 1900 its imports of dynamos, motors and other electrical goods totalled 214,000 dinar, showing, however, a fall of 15,000 dinar on those of the previous year. Germany's share of the trade in both years amounted to 77,000 dinar. The honours of the chief supplier fell to France. Of other electrical goods the imports were 643,000 dinar, almost 50 per cent. below the figures of the foregoing year. Germany was the leading contributor with goods to the value of 335,000 dinar; France supplied 168,000 dinar, and Austria 126,000. No doubt can be entertained, says the Consul, that the call for these articles will increase, as all the concomitants therefor are present, such as water power for the establishment of generating stations, demand for industrial undertakings, high price of petroleum, and the defects of local gas works.—*Elektr. Nachrichten.*

Electric Lighting in a Hindu Temple.—According to a correspondent of the *Statesman* (India), the famous temple of Kali, at Kalighat, has, after all, been provided with an electric installation. "When a proposal was first made, some of the orthodox Hindus asked each other 'are electric lights permissible in a Hindu temple?' The learned body of Sebait Samiti at Kalighat held several sittings, and after fully discussing the matter with pundits and scientists, they came to the conclusion that there was nothing objectionable in electric wires and accessories to forbid their introduction into a Hindu temple. The cost of installation and consumption is borne by two Hindu gentlemen who do not wish their names to be disclosed. The installation is received by the Hindu community with immense delight, as the pilgrims visiting the temple used to be very much inconvenienced owing to defective lights in the temple. In view of the large influx of pilgrims during the Durga Pujah, the Calcutta Electric Supply Corporation gave the connection at very short notice, and the Hindu community appreciate their promptitude in the matter." An Electrical Review correspondent who sends us the above cutting, says :—"This place is noted for the great Juggernaut Temple which is visited daily by about 10,000 pilgrims, and at the Great Festival in May by over 100,000. Up to now I understand no European has ever been inside. It will be interesting to see if the Hindoo, who is getting more emancipated every day, will install electric light in this famous building, which is 900 years old, the same as has been done in Calcutta."

A Portable Motor for General Agricultural Work.

—The extreme convenience of the use of electricity as the driving power for the many small machines used in agricultural work has hardly been recognised yet. The cost of installing and maintaining numerous small motors, each of which is in use only very occasionally, is one of the chief hindrances, but one which would soon disappear if the custom of employing a single portable motor for the whole miscellaneous work of the farm became more general. A motor suitable for such work has been recently brought out by a Swiss firm, and is described in *L'Electricien*.

A general view of this combination is given in fig. 1. It will be seen that it consists of a small semi-enclosed motor (of from 2 to 6 H.P., according to the work to be dealt with), mounted on a light angle iron trolley on two wheels. The breadth between wheel centres is only 16½ in., so that it can be drawn along the narrowest

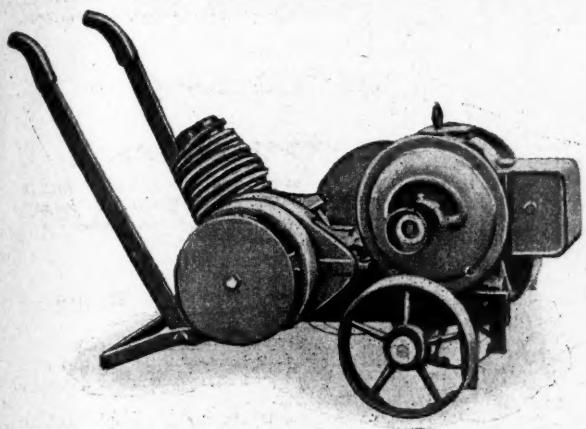


Fig. 1.

paths or passages. The weight is carefully distributed, so that only some 49 lb. falls on the handles. One end of the motor spindle carries a pinion which drives a countershaft, carrying at one end a double pulley, and at the other the pinion of a second reduction gear also driving a double pulley. Finally, the free end of the motor spindle carries a small pulley. In this way five distinct belt speeds are made available of the values of 102, 155, 530, 840 and 1,950 ft. per minute respectively. Further, the addition of an end disk to the lower speed pulley transforms it into a simple hoist drum suitable for winding up loads, such as sacks, &c.

As an alternative, the disk can be replaced by a simple adjustable crank and connecting rod for the purpose of providing reciprocating motion when necessary for pump driving or similar work. At the back of the trolley a small cable drum is fixed carrying 20 yards of cable attached to the motor terminal board at one end, and

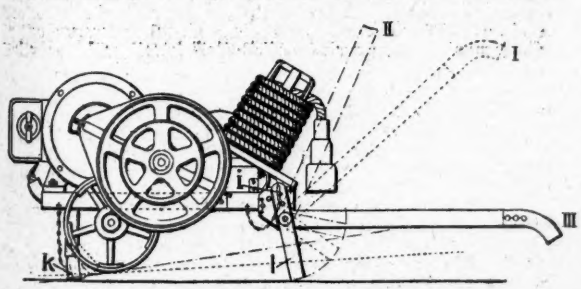


Fig. 2.

fitted (for three-phase supply) with a four-way plug connector at the other end. The fourth plug is for the purpose of earthing the motor frame. The socket for the plug has five ways arranged so that the motor will rotate one way or the other, according to the way in which the plug is inserted. The enclosed terminal board is mounted direct on the motor and carries a suitable triple-pole switch.

It will be seen from fig. 2 that the trolley when at work does not rest on its wheels at all, but stands firmly on four legs, the change being readily effected by a single person by suitably manipulating the handles, first into position I, to enable the front legs to be set, and then into position III, which raises the wheels off the ground.

A portable machine of this type is obviously readily applicable to work of the most varied kinds, including the driving of thrashing machines, sifters, chaff-cutters, winnowing machines, crushers, sewage pumps, wine presses, mills, hoists, band saws, circular saws, and, in fact, practically any of the machines met with on a farm.

Institution and Lecture Notes. — Institution of Electrical Engineers (Glasgow Section)—The tenth annual dinner of this Section will be held at the Grosvenor, Gordon Street, on December 12th. The inaugural address by the chairman of the Section will be delivered on November 14th. Other arrangements in the programme for the session are:—December 19th, Prof. F. G. Baily on "The Heriot-Watt College Laboratories." January 9th, 1912, Mr. J. B. (?) Mackenzie on "Illumination." The Students' Section opens on October 20th, with an address by Mr. W. W. Lackie, the chairman.

Rugby Engineering Society.—The syllabus for the session 1911-12 contains the following arrangements:—

Meetings.

October 12th, paper on "Multiple-effect Evaporation," by E. R. Briggs.
November 16th, lecture on "Gyrostats," by R. C. Clinker.
December 14th, paper on "Machine Shop Practice," by P. V. Vernon.
January 11th, 1912, paper on "Air-Compressor Efficiency," by B. M. Woodhouse.
February 15th, paper on "Workshop Economics," by J. Picken.
March 21st, paper on "High-Speed Electrical Machinery," by F. H. Clough.

Visits.

October 14th, National Physical Laboratory, Teddington.
October 28th, Portland Cement Works, Rugby.
Other visits are being arranged.

Two premiums of £2 2s. each are offered to writers of papers.

Association of Mining Electrical Engineers (East of Scotland Branch).—The following dates for meetings and special district lectures—the latter with a view to popularising the work of the Branch and the Association generally—have been provisionally fixed: Friday, November 10th, special lecture at Alloa. Friday, December 8th, general meeting at Dunfermline. Friday, December 22nd, special lecture at Wemyss. Saturday, January 6th, 1912, general meeting at Edinburgh; Friday, January 19th, special lecture at Cowdenbeath. Friday, February 16th, general meeting at Dunfermline. Saturday, March 9th, general meeting at Edinburgh. Friday, March 29th, general meeting at Dunfermline. Saturday, April 20th, general meeting at Edinburgh: and Friday, May 24th, annual business meeting at Dunfermline.

The opening meeting for the session of the West of Scotland Branch of the Association was held on October 20th in the Technical College, Glasgow. It was reported that the total membership of the branch stood at 134. Mr. Alexander Anderson, Motherwell, in the course of his presidential address, said the demand for earthing all apparatus had added to the duties of the colliery electrical engineer, and in this connection he urged the necessity for a little theoretical knowledge. Earthing systems could not be relied upon unless they were carried out in strict obedience to Ohm's law. He announced that during the present session prizes would be presented for the best papers contributed by Scottish members of the Association who were acting colliery electrical engineers.

Reunion of Old Cromptonians.—One hundred Cromptonians, past and present, dined together at the Trocadero Restaurant on Saturday, October 14th, under the chairmanship of their old chief, Col. R. E. B. Crompton, C.B., R.E. As it was some 20 to 30 years since many of those present had left the Crompton Works, the meeting was of particular interest, and gave an opportunity to many to renew friendships which dated back to the earliest days of electric lighting in this country.

Mr. W. A. Chamen acted as vice-chairman, and Col. Crompton was supported at the chairman's table by, among others, Mr. James Swinburne, a former works manager at the Arc Works, and Mr. A. P. Lundberg, Col. Crompton's first assistant at the works.

Mr. Chamen, in proposing the toast of "Cromptonians, Past and Present," recalled some of the experiences met with in their earlier contracts, and enumerated the many responsible positions occupied at the present time by those who had at one time been associated with the company. He added that there were no fewer than 25 Old Crompton men occupying at the present time the position of chief engineer to electric lighting and power undertakings, and further, that the names of men such as James Swinburne, Gisbert Kapp, A. P. Lundberg, Sam Mavor, J. F. C. Snell, J. W. Kempster, A. Bergtheil, &c., bore witness to the important part which the old firm had played in the building up of the electrical industry.

Col. Crompton, in a happy speech, declared how pleased and proud he was to see around him so many of those who were associated with him in his earlier days, and how gratifying it was to him to realise that many of those who had started their engineering life with him had, after going out into the world, made names and positions for themselves. He felt convinced that whatever branch of engineering or business might lie before a man in after life, the precision gained during training at electrical work formed a more sound ground work than did many other branches of engineering.

The dinner was organised by a Committee consisting of Messrs. W. A. Chamen, S. Dobson, E. J. Fox, H. Leaf, C. Peel, A. H. Pott and W. L. Pakenham. Many still associated with the company were present; among others, Lieut.-Col. Clibborn and Mr. B. Gibson, directors, and Messrs. E. Reeves and A. H. Hodson, joint managers.

Educational Notes.—Northampton Polytechnic Institute.—At the invitation of the Governors, under the new scheme of management recently sealed by the Charity Commission, the Duke of Connaught has accepted the office of President of the Polytechnic.

Faraday House.—Mr. R. J. Wallis-Jones will begin a series of demonstrations of electric welding and allied processes to the senior students on November 8th.

Appointments Vacant.—Improver, for the Perth Corporation electricity works (15s.); commercial assistant (£2 and commission) and draughtsman (35s.), for the Batteries B.C. See our advertisement pages to-day.

Steam Turbine Tests.—Referring to the abstract which we recently published of a paper on the subject of "Steam Turbines," read by Mr. H. Zoelly before the Zurich meeting of the Institution of Mechanical Engineers, the British Thomson-Houston Co., Ltd., write pointing out that this paper contains disparaging references to the compound velocity impulse turbine, and, as the principal makers in this country of the "Curtis" turbine—the only turbine in which this system is employed in its entirety—they ask us to publish the following :—

"Mr. Zoelly states that governing by means of successive groups of nozzles is unsatisfactory, and unsuitable for parallel running. So far as our machines are concerned, that statement is not in accordance with the facts, as we have over 50 machines in this country running in parallel with engines or turbines, and in every case this form of governing is operating successfully.

"Mr. Zoelly also specially remarks that he has proved, after many years of experimenting and testing, that it is not possible, under most favourable conditions, to obtain with the compound velocity turbine a higher thermal efficiency than 58 per cent. We can only say that his researches could not have been complete, as the thermal efficiencies of "Curtis" turbines given below are considerably higher than 58 per cent., and compare well with those given by Mr. Zoelly as having been obtained with his turbines.

"In order that the results may be readily compared, we have reproduced Mr. Zoelly's table, and in doing so we have given the superheat of the steam instead of the total temperature, as this

Some Test Results obtained with Zoelly Steam Turbines.

Installation.	KW. load.	Pressure. Lb. per sq. in. gauge.	Superheat. Deg. F.	Vacuum. Per cent.	Steam consumption. Lb. per KW.-hr.	Steam consumption. Lb. per H.P.-hr.	Thermal efficiency per cent.
4,000-KW. turbine, Charlottenburg. 1,000 R.P.M. Tested Dec., 1910	4,189	164·7	184	95·8	13·25	9·36	68·7
	3,092	168·3	184	96·2	13·77	9·58	66·2
	2,199	161·9	147	97·4	14·40	9·84	63·2
	1,138	166·9	147	97·8	16·00	10·12	59·9
2,000-KW. turbine, Helsingfors. 3,000 R.P.M. Tested Nov., 1910	2,052	179·0	205	94·9	13·04	9·18	70·5
	1,514	181·7	183	95·5	13·67	9·52	67·2
	1,026	177·5	187	95·8	14·53	9·76	65·2
	510	171·8	167	96·6	17·33	10·68	58·8
1,700-KW. turbine, Hagendingen. 3,000 R.P.M. Tested Dec., 1910	1,691	206·0	280	93·3	13·04	8·91	69·7
	1,366	202·3	284	94·2	13·77	9·18	66·5
	851	205·2	272	95·2	15·52	9·81	61·0
	457·5	208·0	256	94·9	18·91	10·68	57·1
1,200-KW. turbine, Aurich. 3,000 R.P.M. Tested Dec., 1910	1,235	162·3	79	94·0	15·34	10·77	67·0
	949	164·0	70	95·5	15·99	11·08	62·8
	606	166·7	53	96·5	17·1	11·48	59·9

Some Test Results obtained with Curtis Steam Turbines.
The British Thomson-Houston Co., Ltd., Rugby.

Installation.	KW. load.	Pressure. Lb. per sq. in. gauge.	Superheat. Deg. F.	Vacuum. Per cent.	Steam consumption. Lb. per KW.-hr.	Steam consumption. Lb. per H.P.-hr.	Thermal efficiency per cent.
3,000-KW. 1,500-R.P.M. turbine, Olympia Oil and Cake Co., Selby. Tested April, 1911.	2,987	140	144	89·4	15·96	11·2	70·2
	2,280	145	137	91·3	15·90	10·9	68·9
	1,584	150	151	91·7	17·10	11·43	64·8
1,500-KW. 1,500-R.P.M. turbine, The Fife Power Co., Dunfermline. Tested September, 1911.	1,541	135	8	93·4	17·46	12·12	65·7
	1,185	129	15	94·7	18·05	12·3	63·1
	739	129	7	95·3	19·3	12·52	60·9
1,250-KW. 3,000-R.P.M. mixed-pressure turbine, The Bedwas Navigation Colliery Co., Ltd. Tested December, 1910.	1,566	140	106	92·1	16·95	12·04	63·7
	1,185	140	102	91·7	17·2	12·05	64·4
	893	141	98	91·7	18·55	12·78	60·7
	626	140	100	91·7	20·35	13·6	56·9
	1,268	1·5	23	91·6	29·8	20·95	73·4
	916	1·4	23	91·7	31·5	21·65	70·9
	548	1·6	24	91·5	37·5	24·72	62·0
1,000-KW. 3,000-R.P.M. turbine, Messrs. W. N. Brunton & Sons, Ltd., Musselburgh. Tested May, 1911	1,221	120	98	90·8	17·75	12·5	65·1
	995	120	99	92·7	17·3	12·07	65·0
	500	120	89	91·8	19·9	13·1	61·1

gives at a glance a better idea of the conditions. Below his schedule we have tabulated test results on "Curtis" turbines built by this company at Rugby. It should be noted that we have omitted the column of efficiencies based on conditions behind the stop valve, as these are of no interest to the user, who is only concerned with the efficiency of the machine based on the steam conditions in front of the stop valve.

"In accordance with the more conservative practice in this country, the superheat in our tests is generally lower than in the tests published by Mr. Zoelly, with the result that our efficiencies are somewhat lower than would have been the case had our tests been carried out with a higher degree of superheat, it being well known that the thermal efficiency of a turbine increases with an increase of superheat.

"We should add that all the test results of "Curtis" turbines given in the above tables were obtained on official tests."

Turbine Accident.—According to the *Daily Telegraph*, an explosion which occurred on Tuesday afternoon at the Albion Engineering Works of Greenwood & Batley, in Armley Road, Leeds, caused serious injury to a fireman, Arthur William Irwin, of Horsforth, who, with a second sufferer, was removed to the infirmary. The latter was not detained. The explosion occurred in the power station, shattering all the windows and considerably damaging the building. The machinery is worked by turbine power, and it was discovered that one end of the turbine had been blown out. All the machinery was stopped. Nearly 1,000 men had to cease work temporarily.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials. — Mr. R. H. Campion, borough electrical engineer of Dewsbury, is now well on his way towards recovery from a severe illness which has prevented him from performing his duties for nearly four months. Mr. Campion had an attack of double pneumonia, and for some time his condition caused grave anxiety.

Mr. Cecil C. Fowler, deputy manager at the Brighton electricity works, has resigned, he having obtained an appointment in India. Mr. Fowler has been with the Brighton Corporation for 19 years.

Tramway Officials.—Mr. W. T. Dawson, Buckhaven, Fife, has been appointed manager of the Wemyss Tramway Co. in place of Major Marshall, V.C., resigned.

General.—Messrs. Ernest Long and Robert Crawford, who have been for many years with Messrs. W. T. Glover and Co., Ltd., Manchester, in charge of power, tramway and general electrification contracts, have now started business as Long & Crawford, Ltd., at 28, Deansgate, Manchester. They are specialising in collieries and textile works equipment and general power work, and want trade catalogues and lists.

The *Australian Mining Standard* states that Mr. H. G. Such, general manager of the Union Electric Co. of Australia, Ltd., has just returned to Sydney from a tour through South Australia and West Australia. "Mr. Henry F. Nichols has been appointed as the company's agent for the sale of motors, switchgear, &c., in South Australia, whilst the firm of Ritchie & Jackman, 197, Murray Street, Perth, have been appointed as the sole agents for West Australia. In both places heavy stocks of the 'Excello' lamps, motors, instruments, &c., are carried. Mr. Such states that the electrical market in Perth shows distinct signs of increasing activity, and that before long electrical business in that State will prove of considerable interest to the trade. At the present time, it is stated that there are over £250,000 worth of buildings in course of erection in Perth alone."

An Australian exchange states that Mr. G. G. Balsillie, the expert recently appointed to take control of wireless telegraph operations within the Commonwealth, arrived in Melbourne last month. The same journal also records that Mr. R. P. Wilson, a member of the firm of Merz & McLellan, electrical engineers, London, who was recently in Melbourne in connection with the proposal to electrify the suburban railways, is about to visit Australia again. Mr. P. Norwood, formerly assistant electrical engineer for the Newcastle (N.S.W.) Council, has been appointed electrical engineer to the Inverell Council, where a system of electric lighting is being installed.

It is announced that Captain Harry Mance, R.E., eldest son of Sir Henry C. Mance, is to marry Miss Stenhouse, younger daughter of Major-General W. Stenhouse, Indian Army, at St. Peter's Church, St. Albans, on November 2nd.

Obituary.—Mr. John Conacher.—Many of our readers interested in electricity supply within the Metropolitan area will have heard with deep regret of the death of Mr. John Conacher, who, some years ago, rendered splendid service as general manager of the Metropolitan Electric Supply Co., Ltd. Prior to his connection with that company, he had shown valuable qualities in railway management, and it was to return to work in this sphere that he retired from his responsible position with the Metropolitan Electric Co. a few years ago. Mr. Conacher passed away on Wednesday last week at the age of 66 years.

Mr. W. G. Hull.—The death occurred on October 16th, from injuries received in a cycle accident, of Mr. Wm. Geo. Hull, who was in business as an electrical engineer at Thames Avenue, Pangbourne (Berks.). Deceased, whilst proceeding to execute work at Goring, was thrown from his cycle and picked up dead. He was a member of the Parish Council and a prominent Churchman.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Grimshaw, Baxter & J. J. Elliott, Ltd.—A memorandum of satisfaction to the extent of £500 on September 29th, 1911, of debentures dated April 6th, 1909, securing £19,850, has been filed.

Lamplough & Son, Ltd. (99,688).—Particulars of £6,000 debentures, created September 25th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, including uncalled capital. No trustees.

Barbados Electric Supply Corporation, Ltd. (104,367).—Charge dated September 23rd, 1911, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Anglo-American Debenture Corporation, Ltd., 20, Birchin Lane, E.C

South Metropolitan Electric Light and Power Co., Ltd. (47,875).—Issue on September 27th, 1911, of £10,000 debentures, part of a series of which particulars have already been filed.

English Electrical Co., Ltd. (112,639).—Particulars of £3,000 debentures, created September 7th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £1,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Llangollen and District Electric Light and Power Co., Ltd. (75,384).—Debenture dated October 4th, 1911, charged on the undertaking and general assets, to secure £500. Holder: P. H. Mitchell.

British L. M. Ericsson Manufacturing Co., Ltd. (79,061).—Issue on October 1st, 1911, of £13,000 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

National Telewriter Co., Ltd.

Mr. E. W. W. Edwards, who presided at the meeting held last week in London, said that in March last, when it was considered desirable, in view of the position and volume of the company's business to reduce the number of directors, Sir W. Treloar, Sir A. K. Rollit, Mr. Liddell and Mr. A. R. Prideaux withdrew. Turning to the accounts, the income from rentals showed a considerable increase, but, owing to several causes, their progress had been seriously retarded. The chairman went on to refer to the difficulties with which they had been confronted, and the steps taken to overcome them. At the date of the last meeting measures had been framed for the active development of the business, and new subscribers were obtained, but unfortunately it became increasingly evident that in many cases they were unable to cope successfully with the widely varying conditions in connection with private line work without incurring expenses for maintenance which were commercially prohibitive. At the time the company was formed the board, acting on the experience obtained with some 100 machines, which had already been in constant use for several years throughout the London district, placed an order for 700 instruments for interior and private line work, with an electrical firm of the highest standing. These machines were constructed on the basis of the latest technical information then obtainable, but in the light of practical experience, the user of the instrument had disclosed defects which made it difficult, even with the most careful supervision, to obtain that general expression of satisfaction which was necessary for the proper development of the business. One of the main difficulties lay, not so much with the instrument itself as with the devices which were necessary to transform and deal with the line currents and voltages of the various electrical systems. This was the position with which they were confronted in November last, and in view of the circumstances it was deemed prudent, for the time being, to close down the contract department, and to deal only with such inquiries as arose in the ordinary course of trade. Prompt measures were immediately taken to deal with the technical position, and in November last one of the directors left for America, where several thousand instruments of American manufacture were already in public use, in order to negotiate with the American company with a view to obtaining the benefit of their wider technical knowledge and practical experience. Exhaustive tests made with the instruments of the American company had satisfied the board that they were superior in design and construction to the English instruments for interior and private line work, and that they fulfilled the requirements and conditions of telewriting in commercial practice. They were endeavouring to eliminate from their installations all unstable units, such as batteries, electric valves and similar devices, for which small motor-generators would be substituted, which would have the effect of reducing the cost of maintenance to a minimum, while efficiency would be proportionately increased. Arrangements with the American company were in course of completion for the supply of instruments on terms which compared favourably with prices paid to British manufacturers, for a full exchange of all technical information, and for the formation of a British company to deal with the European and Colonial rights of the American companies in which the National Telewriter Co. is substantially interested. The general agreement embodying these arrangements would, it was expected, be very shortly signed. In view of the serious issues involved, the directors conferred with a number of the principal shareholders in March, and they expressed the unanimous opinion that the only policy to be pursued under the existing circumstances was to continue to push forward the company's business and to purchase American instruments. A limited number of instruments, involving an outlay of about £2,000, was accordingly ordered, and these were now being installed with some of the principal users, but if these gave the results they anticipated, the greater part of the private line instruments at present in use would have to be replaced, a step which would involve further substantial expenditure. In regard to the Telewriter Exchange, from which they hoped to obtain a large proportion of their revenue, the number of their subscribers had steadily increased, and the volume of calls, chiefly dealing with the transmission of telegrams between the subscribers and the General Post Office, had now reached substantial proportions. The Telewriter Exchange was gaining in public favour, and were it not for the technical difficulties, the number of subscribers would have been trebled, or possibly quadrupled. The rapid growth of the exchange system would depend upon the extent to which written communication for the transmission of orders, &c., was appreciated by business houses, and the more this practice was recognised the easier it would become to control fresh subscribers from sources such as the railway companies, carriers, theatres, box offices, co-operative stores, clubs, &c. They had reopened their contract department, and canvassing had been resumed under the supervision of an experienced telephone contract officer, and they might reasonably look to a very considerable extension of business in the future. A great deal of spade work had been done in the provinces, and installations have been obtained with a number of important firms in Manchester, Liverpool and other industrial centres. The telewriter has been exhibited both at the Glasgow Exhibition and at Olympia, where it has aroused great interest, and led to inquiries from important corporations, which, it was hoped, would result in business. After referring to the inquiries received from and business done abroad, the Chairman moved the adoption of the report (see Electrical Review, page 673).

Mr. Ellice-Clark seconded, and after a number of questions had been asked and answered, the motion was carried.

Edison & Swan United Electric Light Co., Ltd.

The directors' report for the year ending June 30th, 1911, states that the net revenue account shows that the sum of £49,154 has been brought forward from profit and loss account. Interest on debenture stocks has absorbed £15,702; £5,500 has been set aside as depreciation on freehold and leasehold property, plant and tools; £7,500 has been applied in writing down values of stocks, and the sum of £1,439 has been reserved on account of bad and doubtful debts. The result, as shown in the net revenue account, is a credit balance of £19,013, to which must be added the sum of £6,843, brought forward from the previous year, thus making a total of £25,856. Of this amount the directors propose to place £17,500 to reserve fund, carrying forward £8,356. Cost of establishing the business, goodwill, &c., £390,432, has been brought forward at the figure standing in the last balance-sheet. The freehold and leasehold property and plant have also been brought forward at the value stated in the last balance-sheet, with the addition of the amount expended to June 30th, 1911, less depreciation charged in net revenue account. The shares of the Altrincham Electric Supply, Ltd., have been taken at par, as in previous years. This concern continues to progress, and has paid the usual dividend on its shares of 7 per cent. for the year ended December 31st, 1910. Its indebtedness to this company has been reduced during the year by £328. There has been expended on capital during the year ending June 30th, 1911, £5,361, mainly on account of plant in connection with the manufacture of metal-filament lamps. The trading since the close of the financial year on June 30th last shows satisfactory progress.

Auckland Electric Tramways Co., Ltd.—The directors report that the total revenue for the year to June 30th was £216,624. The traffic receipts, which amounted to £210,167, show an increase of £22,838 over the previous year. After deducting all expenses chargeable to revenue, including £16,878 for debenture and other interest, the rental and percentage of profits payable to the Auckland City Council, amounting to £4,718, and setting aside £20,000 to the depreciation account, there is a surplus of £43,575, making, with the balance brought forward, £49,648. The directors recommend (says the *Financier*) that £15,000 should be placed to reserve account, and a dividend on the ordinary shares at the rate of 7 per cent. per annum, in respect of which an interim dividend for the half-year to December 31st, at the rate of 6 per cent. per annum, was paid in May, leaving £7,148 to be carried forward. During the year £3,600 5 per cent. first mortgage debenture stock was redeemed and cancelled under the operation of the sinking fund, reducing the amount outstanding at June 30th to £321,932. The stock was redeemed at a premium, which has been charged direct to the profit and loss account. Subsequent to June 30th an issue of £50,000 in 6 per cent. preference shares had been made. These shares were offered to the existing shareholders at par, and the whole of them have been taken up.

Sunderland District Electric Tramways, Ltd.—The report states (says the *Financier*) that the accounts for the year to October 31st show, after providing for interest on the prior lien bonds and first and second mortgage debentures and loans, and the Receiver's remuneration and expenses, a loss of £1,599, making a total loss of £16,202. A scheme for the reorganisation of the company is in course of preparation.

Callender's Cable and Construction Co., Ltd.—The directors have declared the usual interim dividend on the ordinary shares at the rate of 10 per cent. per annum.

British Thomson-Houston Co., Ltd.

THE sixteenth ordinary general meeting of this company was held at the offices, 83, Cannon Street, on Wednesday last week, under the chairmanship of Mr. J. F. Nauheim.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 624), said that they had given the shareholders a very full account of last year's business, and if the profits of the period ending March 31st, 1911, this year were not so large as those of the preceding 12 months, it was owing, first, to the fact that, as they stated in the report, the improvement in business came too late to affect the present balance-sheet, while, on the other hand, their expenses in connection with advertising and the charges for interest on loans during the year had largely increased. They had been continuing, in fact, their pioneer work, which they fully expected would yield good results in the near future. The works continued to be fully occupied, and only the previous day when he was in Rugby he had the satisfaction of seeing that business was very active at present, and he was told by the chiefs of the various departments that they were as full of work as they could be. The value of their orders from March 31st last, when they closed their books, up to last Saturday, was very largely in excess of the corresponding period last year. While this in itself was very satisfactory, he was sorry to say that the percentage of profit still remained low, competition being almost as keen as ever, and it must be remembered that they were continuing to spend large sums in advertising and other progressive work, in the effort to thoroughly establish their drawn-wire lamp in the position to which its merits entitled it. In looking over the balance-sheet, on the debit side they found that their indebtedness to the General Electric Co., of New York, had largely increased, and they had taken a loan of about £50,000 from the bankers. On the other hand, they would see that the expenditure at Rugby for the factory had been £52,000 during the year; the item of apparatus, &c., at Rugby showed an increase of £50,000; and the money outstanding due to them also showed an increase of £50,000. Their holding of shares and debentures had gone up by about £75,000. They had an opportunity of acquiring a block of shares in a very well organised concern in this country, paying a good dividend. As mentioned in the report, they would in future close their books on December 31st, which would be a great convenience to all the staff, and enable them to present the report before the summer holidays. It would interest them to hear that they had that day authorised a further extension to the iron foundry, and the erection of a large four-storey building for general manufacturing purposes. He also invited their attention to "Mazda House," the extensive premises which they had taken in Upper Thames Street for the lamp and wiring supplies business, and which was one of the finest and most up-to-date buildings in London used for a similar purpose. This would be opened in a few days. These extensions emphasised the confidence which they and their friends had in the future of the business. He hoped when they next met the report would show further signs of improvement, and that their progress from now on would fulfil their expectations.

MR. G. FRANKLIN seconded the motion, which was adopted without discussion.

Ferranti, Ltd.

THE sixth annual general meeting of Ferranti, Ltd., was held at Basildon House, E.C., on Friday, under the chairmanship of Mr. A. W. Tait.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 653), said he was sure that the shareholders would feel that the accounts were satisfactory, as showing a considerable extension of the business. The trading profits for the year amounted to £49,074, against £41,236 last year, being an increase of almost £8,000. The net profits, after providing for general establishment charges, repairs, renewals, &c., amounted to £22,045, against £17,392, being an increase of £4,652. It would be observed that the general charges were larger, owing to increased development work, whilst repairs and renewals amounted to £4,877, as compared with £3,159, showing that the machinery and plant were being efficiently maintained. The net profits for the year had been dealt with as follows: Interest on prior lien debentures, £806; interest on first mortgage debentures, £5,000; interest on bank loan, £1,073; depreciation, £10,000; and prior lien debenture redemption account, £1,000. This amounted to £17,879, and left a balance of £4,166, which, added to the £1,162 brought forward from the previous year, gave a balance to the credit of profit and loss account of £5,327. He would just mention the fluctuations in the main assets and liabilities of the balance-sheet, as at June 30th last. Leasehold land and buildings were £48,543, compared with £46,891; plant, machinery, tools, &c., £105,840, against £100,202; expenditure on work in hand £51,347, against £39,251; stock and stores in hand £11,772, against £10,231; sundry debtors, &c., less reserve, £49,428, against £42,122; cash in bank and in hand, £3,931, against £6,238; and goodwill and patent rights stood at £69,546, as before. On the other side the prior lien debentures were £16,100, against £17,100; the first mortgage debenture stock and interest accrued was £101,250, as before; temporary loan and interest was £3,162; loan from bankers £19,632, against £20,148; sundry creditors £34,214, against £24,379; depreciation reserve account £36,350, against £26,350; and prior lien debenture redemption account £1,000. The principal item was, of course, the increase in the amount for depreciation. Two years ago they placed £5,000 to that account, and last year £7,500, and now they had put £10,000. The directors felt that with a growing business they could not be too careful in dealing with the subject of depreciation, and he was sure the shareholders would agree that the reserve so put aside was a proper one. The business during the year had undoubtedly been progressive, and it looked as if the results would certainly be as good in the present year. One did not like to be a prophet so early in the year, but if the indications which were at present showing were kept up during the whole period they would be able to submit as satisfactory an account next year. He was pleased to say the development of the business was not confined to any one department, but that the meter, switch and transformer departments had all contributed to the improvement. He thought that the customers now felt that the manufactures of the company were of standard first-rate quality, and they were now only in the beginning of reaping the benefit of years of hard work in putting the manufactures of the company on a sound and proper and efficient basis. They were also bringing out certain new lines which had been developed, and on which the company had spent a fair amount of money, which had been charged against the ordinary working expenses of the year. They were bringing out a cooking and heating apparatus, which he thought was meeting with a fair amount of support. If any of the shareholders had been to the Exhibition at Olympia they would have seen the company's stand, which was undoubtedly a certificate to the manufactures of the company. The articles shown were not those which had been made for the purpose of the Exhibition, but were simply the standard articles sold by the company. There was one other matter in regard to the development of the business, and this was the question of capital resources, and later on he would move a resolution to enable them to increase the borrowing powers of the company. He would say they were only taking that step as a matter of prudence without at the moment having any programme to submit. They would be aware that under the memorandum and Articles of Association at the time of the reconstruction, their borrowing powers were restricted to the sum of £150,000. These borrowing powers were all the company had, and the board felt that it was only a necessary measure of prudence that they should get authority to increase the borrowing powers from £150,000 to £200,000.

MR. A. B. ANDERSON (managing director) seconded the motion, and the report was adopted.

The retiring directors and auditors were re-elected, and

The CHAIRMAN then moved:—"That the directors' power to raise or borrow or secure the payment of any sum or sums of money for the purposes of the company, conferred by Article 57 of the Articles of Association, be and is hereby extended, so that the amount at any one time owing in respect of moneys so borrowed, raised, or secured shall not, without the sanction of a general meeting, exceed £200,000."

MR. A. WHITTAKER seconded the resolution.

MR. NALDER said the increased borrowing powers appeared to be justified by the increase of the business, but he understood at present that no dividend could be paid to the ordinary shareholders until the prior lien charge was extinguished. He would like to know if such a condition would attach to the new loan, because if so, he hardly thought it would be fair to the shareholders.

The CHAIRMAN said he had a good deal of sympathy with what Mr. Nalder had stated. As he had said, they had no definite programme with regard to this borrowing, but he thought they might take it to be the desire of the board that if this £50,000 was founded as permanent capital of the company, they would take steps that in connection with the provision of such additional capital they would get rid of the prior lien debentures, which would consequently remove the restriction on the company at present to apply all their surplus profits to the redemption of the prior lien debentures. They knew how difficult it was in a growing business to do this when capital was wanted for the development of the business. They would also have to consider a scheme for dealing with the arrears of dividend on the preference shares, which had run on for the last six years. He had been giving the matter a certain amount of thought, but at the moment he could give no indication of how it would be dealt with. Undoubtedly it was in the minds of the board, and at the proper time some scheme would be brought forward dealing with it, so that when the company was in the position of having sufficient capital to carry on its business, the profits which the board considered it advisable to divide should come to the shareholders in the proper manner.

MR. NALDER said he meant to have prefaced his previous remarks by congratulating the board on the improved results. Two years ago they had a debit balance, and this had now been turned into a credit balance. It looked as if they were progressing, and that they might begin to look forward to the happy time when they would get a dividend.

The resolution was carried.

On the motion of the CHAIRMAN, seconded by MR. ANDERSON, a hearty vote of thanks was accorded the staff for their loyal co-operation.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

British Columbia Electric Railway Co., Ltd.—Further issue of £600,000 4½ per cent. perpetual consolidated debenture stock.

United River Plate Telephone Co., Ltd.—Further issue of 40,000 ordinary shares of £5 each fully and partly (£3) paid.

City of Birmingham Tramways Co., Ltd.—On 18th inst., at Electrical Federation Offices, Kingsway, Mr. E. Garcke presided at a meeting of debenture-holders of the company, at which a scheme of arrangement between the debenture-holders and the company was approved. The meeting was held by order of Mr. Justice Warrington, dated July 28th, 1911.

Swiss Electrical Companies.

The Continentale Gesellschaft für Angewandte Elektrizitat (Continental Co. for Applied Electricity), of Glarus, proposes to pay a dividend of 5 per cent. for 1910-11, being the same rate as in the previous year.

The dividend of the Usines Electrochimiques de Hafsluna, of Geneva, is to be 10 per cent. for 1910-11, as compared with 5 per cent. in 1909-10. A year ago the crisis in the electrochemical industry exercised an unfavourable influence on the market, the prices of carbide and ferro-silicon in particular having been very low.

The directors of Escher, Wyss & Co., of Zurich and Ravensburg, state that the turnover in the 12 months ended last March considerably declined as compared with the preceding year. The unfavourable situation of business continued, and hampered the receipt of the requisite orders, whilst prices further receded in consequence of keen competition. The reduction of orders was particularly felt in the first half of the year, but an improvement took place in the second half, and has been maintained in the new financial year. After appropriating £34,000 for depreciation, as contrasted with £28,000 in 1909-10, the accounts show a loss of £5,200, as against net profits of £17,000 and a dividend of 6 per cent. in 1909-10.

The report of the Maschinenfabrik Oerlikon, of Zurich, states that the unsatisfactory prospects mentioned a year ago were fully realised in 1910-11. Orders were only obtained with difficulty and prices were at the lowest level throughout the year. The scarcely favourable results were attributed to the circumstance that business in other countries was rendered difficult by the exclusion of the company's manufactures from contracts for Governments and local authorities, by the efforts to promote native industries, by the stipulation in many concessions that directly excluded products not made in the country and by protective duties, whilst at the same time inconsiderate cutting of prices prevailed in connection with contracts thrown open to competition. In addition there was a lack of adequate protection in Switzerland. The report states that owing to the unfavourable situation of trade, and as abundant provision for depreciation was made in preceding years, the amount allocated to this purpose in 1910-11 has been reduced, namely, to £23,000, as compared with £31,000 in 1909-10. The net profits are, therefore, returned at £15,700, as against £15,000, and it is proposed to pay a dividend of 4 per cent., being the same rate as in 1909-10. The department for electrical machinery had fewer new installations to carry out than formerly, but it was in part well employed on contracts for existing works and installations. The degree of activity in turbines was good, but prices were unfavourable. Among other work, the branch for electrochemical apparatus completed a large order for the English Ministry of War for the production of hydrogen. The company was successful with the 2,000 H.P. experimental locomotive in the competition for the Lötschberg railway. In addition to the orders received from the latter since the end of the financial year and for locomotives for the Rhatian railways, a number of contracts had been booked for tramways and mountain railways and also for new lines. It is added that the agreement concluded a few years ago with the Siemens-Schuckert works, whereby business in respect of the conversion of Swiss Railways was to be jointly undertaken, had been dissolved by friendly arrangement.

Monte Video Telephone Co., Ltd.

Mr. C. Lock (chairman) presided at Winchester House, E.C., on Tuesday, over the twenty-third annual meeting of this company.

In moving the adoption of the report (see Electrical Review, page 673), the Chairman said he was once again in the position of being able to report moderate progress in the affairs of the company. The amount received by them during the year in the way of subscriptions, rentals, &c., was £52,253, which compared with £46,389 in the preceding year and £43,000 in the year before that, so it would be seen there had been a very substantial increase each year. Of course, this involved a corresponding rise in the working expenses, and this year they had been somewhat unfortunate in the matter of storms, which had caused more damage than usual. However, after deducting the working expenses, administrative charges in London, and providing for the exceptional repairs he had alluded to, they had the very respectable net balance to the credit of profit and loss account of £22,144, which was an improvement of about £1,600 over the net balance of the previous year. They proposed that £13,000 should be placed to depreciation, which was rather more than they had set aside in previous years. This depreciation fund would enable them the better to meet the situation which might arise when they came to install the underground plant should they be so fortunate as to make an arrangement with the Government for that purpose. This was an urgent need for the City of Monte Video in the interests of the public, and they were always looking forward to the necessity of doing it. When it did occur there would, of course, be a good deal of scrapping of the present plant, and the depreciation fund was set aside to meet this scrapping process when the necessity arose. They had already paid interim dividends of 2½ per cent. on the preference and 3 per cent. on the ordinary shares, which absorbed £4,342. They proposed to pay final dividends of the same amount, which would absorb another £4,342, and carry forward £4,381, which would be more than sufficient to meet the next half-year's interim dividends. The principal item in the balance-sheet was the purchase price of the property, which stood at £200,790, and which was a sum materially less than that at which it stood two years ago, before they started their depreciation fund, although during the interval they had made considerable capital expenditure. The figure of £200,000 would be still further reduced by the application of the £13,000 for depreciation, and this would bring the capital value of the system down to what they might call bedrock value as a going concern. The stock of materials was, of course, a fluctuating quantity. Sundry debtors was £2,300 less, due to a closer collection of the accounts. Real estate in Monte Video remained the same, although there was no doubt that the property had appreciated in value, and would probably realise more than the sum named. Investments which cost £23,000 showed an increase of about £9,000, and that was a very substantial addition to their financial resources in one year. There also there was a moderate appreciation in value. They were not all trustee securities, but they were good and sound and of a very liquid and realisable character. He thought the financial strength revealed by the balance-sheet, combined with the satisfactory increase in their subscriptions, offered a satisfactory record and one with which they hoped the shareholders would be satisfied. The Chairman proceeded to refer to his recent visit to Monte Video, during which, he said, he was able to make a very considerable acquaintance with the position of affairs there and with their system. He considered that their system, for an overhead one subjected to all the influences of weather, was very well maintained and in good order, and this was due to the constant vigilance exercised by the manager and his energetic staff, who were continually about the city and the camp looking after the property. He also went into the camp or country, and there he found the branches and exchanges left a good deal to be desired. At the present time the camp system, which they bought some years ago, was leased at an annual rental, and that lease expired last June and was now taken over. The expense of maintaining the property would now devolve on the company, and the work of improving it would be taken in hand systematically. After debiting the amount so far received as rent to the company, he thought the cost of repairs, &c., could be met out of the surplus revenue. They had appointed Dr. A. Rodriguez Larratta, and Mr. C. W. Bayne, general manager of the Central Uruguay Railway Co., as a local board, and expected to derive considerable advantage from the association of these two gentlemen with the company. He interviewed the President of the Republic and several Ministers in regard to the question of the installation of an underground system, and he found that they had studied the telephonic system, and was told that the Government would probably desire to nationalise the telephone service and establish a service of their own. He naturally discussed the matter from the point of view of the company, and after several interviews, he received from one Minister certain suggestions. He could not say they were more than suggestions, but they were quite capable of being worked up into an arrangement, which, if the Government would abandon their idea of nationalisation, would be satisfactory alike to the Government and the company. At the present time he could not say the matter was in a very advanced stage, but it had been left in the hands of the local board, with whom it was discussed in all its bearings, and when the Government were disposed to renew the discussion the local board would be thoroughly equipped to deal with the matter, subject, of course, to reference to the London board. Personally, he was not sanguine of an early settlement, for the Government had in hand large schemes to take over various industries, and in the meantime they must wait patiently.

Mr. J. C. Le Marchant seconded the motion.

Mr. Herzheim having congratulated the board on the progress made, said it was rather surprising that the Uruguay Government should dream dreams of nationalising everything when one read the history of telephony, and became acquainted with the fact that this great public service had reached its highest stage of efficiency in the United States where it was unhampered by official interference.

The motion was carried.

Mr. J. E. Kingsbury, in proposing a vote of thanks to the board, also expressed his regret that the utility of such a service should be hampered by the Government delaying coming to a decision. It would be an advantage if the Government made up its mind one way or the other, and if they wanted a national service, why did they not purchase the company's system as a nucleus.

A Shareholder asked whether there was any understanding between the board and the Government that in case of nationalisation the Government would buy the company out, or would they start an entirely new service and leave the company to do the best they could?

The Chairman said that the views of Mr. Kingsbury had, of course, been impressed on the Government, and, he had no doubt, had had some effect. They had not, of course, raised the question of compensation. They wished to go on, and until the Government moved in the direction of a national service, it would be premature for the company to raise the point.

Prospectuses.—*Anglo-Argentine Tramways Co., Ltd.*—An issue of £1,500,000 of 5 per cent. debenture stock at 97½ per cent. has been offered this week, and the list of applications is to close to-day. The purpose of the issue is to provide capital towards the construction of the subways, and for the general capital purposes of the company.

Fife Tramway, Light and Power Co., Ltd.—Subscriptions were invited last Saturday for 51,195 ordinary shares of £1 each at par.

Metallic Seamless Tube Co., Ltd.—According to the *Financier* the net profits for the year to June 30th were £2,010, and £4,573 was brought forward. A dividend of 7½ per cent. on the ordinary shares is proposed, carrying forward £5,034.

MARKET QUOTATIONS.

Wednesday, October 25th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	"	18/-	..
a " Sulphuric	"	5/6	..
a Ammoniac Sal	"	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a " "	"	£30	..
a Bleaching powder	"	£5 10	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£16	..
a Ferro-Silicon (50 %)	"	£10 10	..
a Copper Sulphate	"	£20	..
a Lead, Nitrate	"	£24	..
a " White Sugar	"	£22 15	..
a " Peroxide	"	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3¼d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a " Chlorate	per lb.	3½d.	..
a " Perchlorate	"	4½d.	..
a Potassium, Cyanide	"	7d.	..
a Shellac	per cwt.	68/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	"	£6 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5 5	..
a Soda, Caustic (white 70 %)	"	£11	..
a " Chlorate	per lb.	3¾d.	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a " Cyanide (basis 100 %)	"	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b " Wire, in ton lots	"	£102	..
b " Sheet, in ton lots	"	£120	..
p Babbitt's metal ingots	"	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c " Tube (brazed)	"	9¼d.	¼d. inc.
c " " (solid drawn)	"	7½d.	¼d. inc.
c " Wire, basis	"	6¾d.	..
c Copper Tubes (brazed)	"	9⅝d.	..
c " " (solid drawn)	"	8⅝d.	..
g " Bars (best selected)	per ton	£72	£1 inc.
g " Sheet	"	£72	£1 inc.
g " Rod	"	£72	£1 inc.
c " (Electrolytic) Bars	"	£68 10	£1 inc.
c " " Sheets	"	£74 10	£1 inc.
c " " Rods	"	£62	£1 10 inc.
c " " H.C. Wire	per lb.	7½d.	¼d. inc.
f Ebonite Rod	"	5/8	..
f " Sheet	"	4/9	..
a German Silver Wire	"	1/11	..
h Gutta-percha, fine	"	5/- to 7/-	..
h India-rubber, Para fine	"	4/3½	2d. dec.
j Iron Pig (Cleveland warrants)	per ton	46/3	1½d inc.
f " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Pig	"	£16	10s. inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 10	..
d Mica (in original cases) small	per lb.	6d. to 2s.	..
d " " medium	"	2/6 to 4/-	..
d " " large	"	4/6 to 8/6	..
p Phosphor Bronze, plain castings	"	11d.	..
p " " rolled bars & rods	"	1/0½.	..
p " " rolled strip & sheet	"	1/1	..
o Platinum	per oz.	185/-	..
e Silicium Bronze Wire	per lb.	8½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	"	£196	£4 inc.
n " Wire, Nos. 1 to 16	per lb.	2/1½	½d. inc.
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	£31 12 6	27/6 dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

MARKETS round the Stock Exchange are still in a somewhat unsettled condition. The continued strength of Consols affords a buttress against selling in the investment markets; and as it is supposed that the Morocco difficulty is practically settled, there is more disposition to buy good securities. The revolution in China and the war in Tripoli are not having much effect upon prices, speaking generally; but business, as a whole, comes very patchily, and the autumn revival upon which the Stock Exchange can, as a rule, depend, still delays its advent.

The Railway Commission report had the effect, in the first place, of putting Home Rails better, though subsequently prices fell away, with a few exceptions, the latter being confined principally to the Kentish stocks, whose buyers pin their faith to a successful issue of the Kent coal business. It is feared, however, that the absence of recommendation as to how strikes are in the future to be averted will tend to vitiate the usefulness of the report, with which some of the representatives of the men have not been slow to express vigorous dissatisfaction. So far as the Electric prices are concerned, City and South London continued its rise, and gained another ½, but Metropolitans and District 4 per cent. Debenture are both a point lower. Underground Electric Railway shares have risen ⅛, and the Income bonds 2, the remainder of the stocks being unchanged.

British Electric Traction Ordinary are being bought and recovered their ⅛ of last week. Pending the result of the conference between the company and what may be called the dissentients, the market is a little fearful of making prices. The opinion of the majority in the Stock Exchange seems to favour the hope that the directors' scheme will go through, in spite of the opposition raised against it. No doubt, as we suggested last week, something in the nature of a compromise will be arrived at. Amongst the other English Traction descriptions, Bath 4½ per cent. Debenture rose 3 points, while smaller improvements have been gained by Potteries Debenture and Metropolitan Electric Tramways Debenture stocks.

The Mexican group is steady, with rises in Mexico Tramways Common stock and the 6 per cent. bonds, the latter hardening to 100½. The feature, however, in this department is a rise of 8 in Montreal Light, Heat and Power, where the recent highly satisfactory report has brought in buyers, in addition to which there are still rumours of amalgamation. Electrical Developments of Ontario Bonds rose 1 to 90. Amongst the Traction issues, Anglo-Argentine Trams 5 per cent. Debenture stock eased off to 100 on the new issue of similar stock at 97½. The first payment of interest on the new stock is due on June 1st, 1912, and will be calculated upon the amounts paid up at that time. Allowing for this, there is not much difference between the two issues, although the new is, as a matter of fact, a little cheaper. Rio Trams went back ½, and the First Mortgage Bonds ¼ upon the revived suggestion of competition in the City. This, however, need not be taken too seriously. Sao Paulo 5 per cent. Debentures are ½ lower. Auckland Tramways Debenture rose 1, and Bombay Second Debenture gained an equal amount, while Winnipeg 4½ per cent. Debenture at 107 is ½ higher. Amongst the shares, Para Electric Railways are a trifle easier, but City of Buenos Ayres Trams at 5¾ show a small rise.

The Electricity Supply market is very quiet, but the tendency shows up rather better. County of London Ordinary at 8⅛ middle, are 10s. to the good, the company's energetic management being recognised in the market. South London Ordinary put on ⅛, and so did County Preference, the latter regaining most of the fall of last week. On the other hand, St. James's are ¼ off again, the price going back to 8¼ middle. A little inquiry for the Debenture stocks is reflected in two or three small rises. Foreign shares are equally quiet, and there is no special change to record.

The Telegraph list is noticeable principally for declines in the Anglo-American trio, all three stocks giving way. The market is moved a good deal in sympathy with that for American rails, while the approach of the settlement this week led to profit-taking in the Deferred by those who had bought more cheaply early in the account. Direct United States shares responded to the buying, of which mention was made here last week, and show a 5s. rise. Western Telegraphs are ½ higher, while Eastern Extensions went back ¼ on realisations, it is said, for account of a deceased holder. The gamble in Marconis received something of a check in consequence of the proposed new issue of shares, and the price at 2⅛ shows a slight loss. But the highly important announcement that Sir Oliver Lodge has joined the company as scientific adviser, and that the Marconi undertaking will absorb the Lodge-Muirhead patents, has afforded the market the utmost satisfaction.

Direct Spanish Telegraph have been flat, losing 10s. Mackay Companies' Common further improved, although the Preferred went back a point.

National Telephone Preferred eased off ½, while the Third Preference slightly hardened, and the Deferred kept steady at 120. Monte Video Telephones rose to 1 middle, the recent report being the cause for the demand. Chili Telephones, however, are ⅛ easier. The revolution in China has made Great Northerns 10s. better. It is thought that whatever damage may be inflicted upon the various companies' property, even if it cannot be reclaimed, will be met by the extra business that the unrest is certain to cause for a long time to come.

Callender's Cable rose ¼, and Telegraph Constructions ½, while Henleys eased off ⅛. The demand for General Electric Preference, to which reference has been made here once or twice, is still a feature in this market, and the price of the Preference shares has been raised ¼ to 9¼ middle. British Thomson-Houston Debenture is unchanged at 95½, although it must be admitted that the company's report shows anything but a pleasant result. The Edison and Swan report, with a fine record of recovery, disappointed some people, who had rather expected a dividend of 2½ to 5 per cent. However, to fortify the reserve and carry forward a substantial sum is manifestly sound policy. We may call attention to the fact that, instead of giving the dividends for 1909, we have this week provided those for 1911, as declared up to the present. It must be pointed out, for the avoidance of misunderstanding, that a good many of the 1911 dividends already declared are interim distributions, and it will not be until the end of the financial years that the full amount can be inserted. Occasion was taken two or three months ago to show the principle on which our dividend tables are arranged, but the difficulties which arise by reason of companies closing their books at all kinds of dates are prolific in raising questions on that point. It is no idle boast to claim that keen vigilance is exercised in the dividend columns set out overleaf, but we are at all times glad to hear of any slip that may creep in, and we take this opportunity of acknowledging the few kindly hints which have been offered us in this connection. The yields are calculated in every case upon the results for the completed year 1910.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 24th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	7⅞ — 8⅛	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8⅝ — 9⅛	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10⅞ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	9†	7⅞ — 8⅛	..	6 3 1
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 7⅞	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	99 —102	..	3 18 5
Charing Cross, West End & City	5	5	5†	3⅝ — 4⅛	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	+ ⅛	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4¼	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	5	4†	3⅞ — 4⅛	..	5 14 3
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	6†	12 — 12½	..	5 12 0
Do. 6 % Cum. Pref.	10	6	6	11¾ — 12¼	..	4 14 1
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	4†	7⅝ — 8⅛	+ ⅛	5 19 5
Do. 6 % Pref.	10	6	6	10¾ — 11¼	..	5 6 8
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	101 —104	+ ⅛	4 6 7
Edmundson's, Ord.	5	Nil	Nil	⅜ — ½	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2 — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	..	5 4 8
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	95 — 98	..	4 11 10
Hove	5	9	8†	6¾ — 7¼ xd	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	8†	6¾ — 7⅛	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	..	1⅜ — 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4½ — 4⅝	..	6 3 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	4†	3¾ — 4	..	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100½—105½	+ ⅛	4 5 4
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4†	3⅝ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102 xd	..	4 18 0
Notting Hill	10	8	6†	..	..	..
Oxford	5	7½	6†	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10†	8 — 8½	— ¼	5 17 8
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	..	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	..	2⅝ — 3	+ ⅛	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	99 —102	+ ⅛	4 18 0
South Metropolitan, 7 % Pref.	1	7	7	1 1/16 — 1 1/16	..	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98	..	4 11 10
Urban, Ord.	5	5	..	⅞ — 1	..	..
Do. 5 % Cum. Pref.	5	5	..	2 — 2⅛	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ — 88½	..	5 1 8
Westminster, Ord.	5	10	10†	7⅜ — 7⅝	..	6 7 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5⅝	..	5 6 8
Calcutta, Ord.	5	8½	..	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 10 11
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7†	106 —109	..	6 8 5
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	..	33/32 — 37/32	..	3 11 1
Do. 5 % Deb.	100	5	..	92 — 95	..	5 5 3
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	89 — 91	+1	5 9 1
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 3/32	..	Nil
Do. 6 % Pref.	1	6	6	1 1/32 — 1 1/16 xd	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101½—103½	..	4 16 7
Madras, Ord.	5	..	..	2⅝ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86½ — 88½	..	5 13 0
Mexican Lt. & Power, Common	$100	4	4†	86 — 88 xd	— ½	4 10 11
Do. 7 % Cum. Pref.	$100	7	7	104½—106½ xd	— ½	6 11 5
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	..	5 4 2
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90 — 92	..	5 8 8
Montreal, Lt., H. and Power	$100	7	8†	178 —183	+8	3 15 8
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	84 — 86	..	13 17 10
River Plate, Ord.	Stock	10	..	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —112	—1½	5 7 2
Do. 5 % Deb. Stock	Do.	5	5	101½—103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	119 —121 xd	+1	3 6 2
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103½—105½	..	4 5 4
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	11¼d.	1⅛ — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½—108½	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	..	7⅛ — 7⅞	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8†	138 —140	..	5 14 4
Do. Collat. Trust	$1000	4	4	93 — 95	..	4 4 3
Anglo-American Telegraph	Stock	3¾	3†	67 — 69 xd	— ½	5 8 8
Do. 6 % Pref.	Do.	6	6	110½—111½	— ¼	5 7 7
Do. Def.	Do.	30/-	..	26 — 26½	— ⅜	5 13 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	7	..	6⅞ — 7⅛	— 1/16	4 18 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	86½ — 88½	..	4 10 5
Cuba Telegraph	10	6	..	10⅜ — 11	..	5 9 1
Do. 10 % Pref.	10	10	10	17½ — 18½	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4†	3⅛ — 3⅜	— ¼	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8¾	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4½	..	8 — 8½	+ ¼	5 5 11
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½—101½	..	4 8 8
Eastern Telegraph, Ord. Stock	Stock	7	5†	136 —139 xd	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	83 — 85 xd	..	4 2 4
Do. 4 % Mort. Deb.	Do.	4	4	102½—104½	..	3 16 7
Eastern Extension	10	7	5†	13⅜ — 13⅝ xd	— ¼	5 1 10
Do. 4 % Deb.	Stock	4	4	100½—102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	..	3 18 5
Globe Telegraph and Trust	10	5⅞	6	10⅜ — 11	..	5 6 10
Do. 6 % Pref.	10	6	6	12⅜ — 13⅜	..	4 9 9
Great Northern Telegraph	10	18	5†	31 — 32	+ ½	5 12 6
Indo-European Telegraph	25	13	..	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	5	5†	87 — 90	- 2	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	73 — 76	— ½	5 5 3
Marconi's Wireless Telegraph	1	5	..	2⅜ — 2½	— 1/16	..
Monte Video Telephone, Ord.	1	6	6†	1/16 — 1 1/16	..	5 12 11
Do. 5 % Pref.	1	5	5	1/16 — 1/16	..	5 6 8
National Telephone, Pref.	Stock	6	6†	103½—105½	— ⅛	5 13 9
Do. Def.	Do.	6	6†	118 —121	..	4 19 2
Do. 6 % Cum. 1st Pref.	10	6	6	9⅝ — 10⅛	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	6	6	9¼ — 10¼	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 1/16 — 5 1/8	— 1/16	4 9 11
Do. 3½ % Deb.	Stock	3½	3½	95 —101	..	3 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	103 —104	..	4 6 7
Oriental Telep. and Elec.	1	8	..	1 3/32 — 1 1/16 xd	..	4 16 7
Do. 6 % Cum. Pref.	1	6	6	1 1/16 — 1 1/16 xd	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½—101½	..	3 18 10
Reuter's	8	5	5†	9 — 9½	..	4 4 3
Submarine Cables Trust	Cert.	6	6	130 —133 xd	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7 1/16 — 7 1/16	..	5 7 7
Do. 5 % Cum. Pref.	5	5	5	5 1/16 — 5 3/16	..	4 10 11
West Coast of America	2½	2½	2½	1⅜ — 1⅝	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	1½	..	2⅜ — 3	..	2 10 0
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅞ — 10⅛	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	6†	13⅜ — 13⅝	+ ⅛	5 0 11
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4% Bnds. A	$1000	4	4	105½—108½ xd	..	3 13 9
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99 —102 xd	..	4 8 3

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Oct. 24th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/8	..	Nil
Do. 5 % Pref.	1	5	5	1/8 — 3/16	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	+3½	5 5 11
Brit. Elec. Trac., Ord.	10	Nil	Nil	1/2 — 1/2	+ 1/8	Nil
Do. 6 % Pref.	10	1½	1½	3/8 — 4/8	..	3 12 9
Do. 5 % Deb.	100	5	5	91 — 94	..	5 6 5
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 79	..	5 13 11
Central London Railway, Ord.	100	8	8†	65 — 67	..	4 9 7
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	48 — 50	..	4 0 0
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1½	12†	30½ — 31½	+ ½	4 15 3
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	105 —105	..	4 15 8
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	..	7/8 — 1½	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	3/8 — 5/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	74 — 79	..	5 13 11
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2½ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	2⅞ — 3⅛	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8
Metropolitan Railway Consol.	100	1⅜	2†	41 — 41½	— 1	3 6 3
Do. Surplus Lands	100	2⅜	3†	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	88 — 90	..	3 17 9
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	..	25½ — 26	..	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	95 — 97	—1	4 2 6
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	3⅜	4¼†	85 — 87	..	3 14 9
Do. 3½ % Gtd.	100	3½	3½	73 — 75	..	4 13 4
Metropolitan Elec. Trams, Ord.	1	5½	5†	3/32 — 3/32xd	..	5 12 4
Do. Def.	1	Nil	..	3/32 — 3/32	..	Nil
Do. 5 % Pref.	1	5	5	1/8 — 1	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	100—102	..	4 8 8
Do. 5 % Deb.	100	5	5	100—102	..	4 18 0
Potteries, Ord.	1	2	..	7/32 — 11/32	..	..
Do. 5 % Pref.	1	5	5	29/32 — 31/32	..	7 12 4
Do. 4½ % Deb.	100	4½	4½	89 — 92	+1	4 17 2
South Metro. Trams, 6 % Pref.	1	6	..	5/8 — 7/8	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 3 11
Underground Elec. Railways	10	..	..	1½ — 1⅝	+ ⅛	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	59 — 61	+2	1 12 9
Do. Power House Debs.	100	4	4	100 —102	..	3 18 5
Yorkshire (West Riding), Ord.	5	Nil	..	1/4 — 3/8	..	Nil
Do. 6 % Pref.	5	Nil	..	2⅜ — 2⅞	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½†	4 15/16 — 5 1/16	..	4 16 5
Do. 2nd Pref.	5	5	5½†	4 15/16 — 4 15/16	..	5 2 7
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 8 9
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	99 —101	— 1	4 19 0
Auckland Trams, 5 % Deb.	100	5	5	103 —106	+ 1	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11⅛	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98 —100	+ 1	5 0 0
Brisbane Trams Invt., Ord.	5	8	..	6 7/8 — 7 1/8	..	5 12 8
Do. 5 % Pref.	5	5	5	5 — 5 1/8	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	..	141 —145	..	5 10 4
Do. Pref. Ord.	100	6	6	121 —125	..	4 16 0
Do. 5 % Pref.	100	5	5	108½ —111½	..	4 9 8
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101 xd	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101½ —103½	..	4 5 4
Calcutta Trams, Ord.	5	6	..	5 3/32 — 6 1/32 xd	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5 1/32	..	4 15 8
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	..	7/16 — 9/16	..	Nil
City Buenos Aires Trams (1904)	5	5	2½†	5 3/32 — 5 7/32	+ 1/16	4 5 1
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101½ —104½	..	4 15 8
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	5	6†	62 — 66	..	7 11 6
La Plata Elec. Trms, Prf.	1	6	6	25/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	5†	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	96 —100	..	5 0 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	5	5	90 — 92	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7†	117⅛ —119½ xd	+ ½	5 17 2
Do. Gen. Con. 5 % Bonds	..	5	5	98½ —100⅝	..	4 19 6
Do. 6 % Bonds	100	6	6	99⅛ —101⅛	+ ⅛	5 18 3
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7 — 7⅛	—1/16	6 15 7
Do. 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99½ —101½	..	4 18 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1/2 — 1 5/8	..	2 7 1
Do. 5 % 1st. Deb.	100	5	5	101½ —103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅛ — 5⅜	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	116½ —117½ xd	— ½	3 16 7
Do. 1st Mort. 5 % Bonds	..	5	5	101½ —102½	— ¼	4 17 7
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½	..	5 3 8
Sao Paulo Tram, Lt. and P.	$100	10	10†	180 —185	..	5 8 1
Do. 5 % 1st Deb.	$500	5	5	104½ —106½	— ½	4 13 11
Singapore Trams, 5 % Deb.	100	5	5	82 — 85 xd	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5 2 7
Un. Elec. Trams Monte Video	5	6	7	5½ — 6	..	5 0 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	106 —108	+ ½	4 3 4

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	3/8 — 11/16	..	Nil
Do. 6 % Pref.	1	9	6	1 1/16 — 1 3/16	..	7 7 8
Babcock & Wilcox	1	26	24†	5 7/16 — 5 11/16	..	4 11 5
Do. Pref.	1	6	6	1 3/8 — 1 1/2	..	4 0 0
B.I. & Helsby Cables	5	10	8†	6 3/4 — 7 1/4	..	6 17 11
Do. Pref.	5	6	6	5 3/4 — 6 1/4	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	3	Nil	..	1/4 — 1/2	..	Nil
Do. Deb.	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	99 —101	..	5 18 10
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	1/4 — 3/8	..	Nil
Do. 7 % Pref.	2	Nil	..	1/4 — 3/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	..	9½ — 10	+ ¼	7 10 0
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Do. Deb	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	7½†	3⅜ — 3⅝	..	4 16 7
Do. Deb.	100	4½	4½	104 —108	..	4 3 4
Crompton & Co.	3	Nil	Nil	1/4 — 3/8	..	Nil
Do. Deb.	100	5	5	55 — 65	..	7 13 10
Dick, Kerr	1	5	..	3/4 — 7/8 xd	..	5 14 3
Do. Pref.	1	6	6	15/16 — 1 1/16 xd	..	5 12 11
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	..	1/8 — 1/4	..	Nil
Do. fully paid	5	Nil	..	1/2 — 2½	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12 8
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 6 0
Electric Construction	2	Nil	2½†	1/4 — 3/8	..	6 13 4
Do. Pref.	2	7	7	11⅜ — 11⅝	..	7 4 4
Greenwood & Batley, Pref.	10	7	7	7⅞ — 8¼	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9⅛	+ ⅛	5 5 3
Do. Deb.	100	4	4	86 — 91	..	4 7 11
Henley's, Ord.	5	15	10†	11⅞ — 12⅛	— ⅛	5 18 10
Do. Pref.	5	4½	4½	4 13/16 — 5 3/16	..	4 5 11
Do. Deb.	100	4½	4½	106 —108	..	4 2 11
India-Rubber, G. & T.	10	10	..	13⅛ — 15½	..	6 9 0
Do. Pref.	10	5	5	9⅞ — 10⅜	..	4 16 5
Telegraph Construction	12	20	10†	35 — 37	+ ½	6 7 2
Do. Deb.	100	4	4	100 —102	..	3 18 5
Willans & Robinson	1	Nil	..	3/32 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/4 — 3/8	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3 1

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4 per cent., September 21st, 1911.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING SEPTEMBER, 1911.

The September returns of electrical export business compare badly with those of the preceding month, and, indeed, with the last 18 months' figures.

The total of £298,876 is over £100,000 lower than the August total, and one has to go back to February, 1910, to find a month with less export business. The falling off appears to be mainly due to decreased machinery exports, the decrease that month, as compared with the previous one, being approximately £60,000, but a considerable decline is noticeable in the telegraph and telephone sections.

As an exception to the rule may be mentioned cable exports, which were somewhat better than in August.

Somewhat improved values obtained in the case of the imports, which reached a total of £213,316, as compared with £179,375 in the preceding month, an improvement traceable to increased telegraphic, telephonic and lamp imports.

The re-exports for September amounted to £19,028, a considerable improvement on the previous month's return, when the total only reached £9,795.

On the month, India was by far our best customer, with Victoria, N.S. Wales, Argentina, &c., following. Canada remains a steady purchaser, while Japanese and Brazilian business proved disappointing.

As regards the imports, Germany contributed over 66 per cent. of the goods entering this country.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	589	153	30	201	245	4,416	135	...	...	62	11,458	17,289
Germany	1,404	1,416	176	453	125	2,846	5	...	...	...	190	6,615
Netherlands, Java and Dutch Indies	434	1,460	42	...	105	677	...	16	...	23	11,307	14,064
Belgium	813	554	12	76	200	836	18	...	...	3,491	187	6,187
France	1,487	...	760	178	147	3,527	167	...	...	360	1,703	8,329
Portugal	57	11	24	71	...	151	...	14	...	...	...	328
Spain and Canary Isles	236	...	162	...	90	635	126	...	...	...	53	1,302
Switzerland, Italy and Austria-Hungary ...	593	2,003	514	58	429	930	204	63	...	17	21	4,832
Greece, Bulgaria, Roumania and Turkey ...	251	54	14	16	28	340	15	6	...	27	296	1,047
Channel Isles, Gibraltar, Malta and Cyprus ...	107	406	17	38	15	106	...	18	...	41	572	1,320
U.S.A. and Cuba	...	...	44	350	75	509	...	94	...	...	656	1,728
Canada and Newfoundland	678	3,639	581	2,400	2,200	6,542	...	41	...	431	290	16,802
British West Indies and British Guiana ...	31	42	55	77	...	73	...	...	...	56	34	368
Mexico and Central America	615	30	...	...	...	89	1,660	43	...	237	180	2,854
Peru, Uruguay and Paraguay	49	50	279	...	...	418	...	...	...	374	...	1,170
Chile	296	455	153	337	108	1,764	43	359	...	192	220	3,927
Brazil	253	637	217	456	206	3,723	602	280	17	1,031	5,296	12,718
Argentina	1,380	5,323	1,177	1,527	1,148	3,455	40	1,736	435	3,746	1,399	21,366
Colombia, Venezuela and Bolivia	...	...	10	...	16	75	...	...	...	...	...	101
Egypt, Tunis and Morocco	108	752	62	37	83	1,100	12	...	1	95	129	2,379
British West Africa and Ascension	4	248	5	100	11	320	...	15	...	284	798	1,785
Rhodesia, O.R.C. and Transvaal	3,729	1,321	280	1,547	73	2,456	20	25	44	86	110	9,691
Cape of Good Hope	1,084	1,805	180	419	102	2,436	11	198	...	46	953	7,234
Natal	1,253	6,206	354	175	52	3,335	198	31	55	84	274	12,017
Zanzibar, Brit. East Africa, Mauritius & Aden	148	81	79	...	19	163	...	122	...	66	330	1,008
Azores, Madeira and Portuguese Africa ...	206	514	254	179	99	500	...	52	...	148	57	2,009
French African Colonies, Madagascar, &c. ...	...	...	...	45	...	60	76	36	...	12	31	260
China and Siam	707	5,563	570	886	...	2,780	83	38	244	42	417	11,330
Japan and Korea	692	2,406	72	284	232	3,735	2,312	1,471	...	2,198	321	13,723
India	2,438	9,288	2,054	3,935	632	10,710	1,605	2,434	224	5,557	1,175	40,052
Ceylon	29	343	49	32	6	100	745	52	...	159	237	1,752
Straits Settlements and Fed. Malay States ...	235	549	59	16	178	476	...	107	14	786	1,260	3,680
Hong Kong	117	1,733	12	...	...	74	110	151	21	32	...	2,250
West Australia	269	476	264	20	45	373	...	7	...	23	49	1,526
South Australia	1,934	1,569	33	186	563	3,516	18	230	...	396	20	8,459
Victoria	1,589	4,850	322	1,463	554	5,094	23	98	53	11,618	194	25,858
New South Wales	1,779	5,288	489	1,458	53	10,630	514	309	...	1,426	782	22,728
Queensland	249	524	...	207	...	1,097	169	...	...	254	50	2,550
Tasmania	14	...	3	13	...	75	...	...	...	161	...	266
New Zealand and Fiji Islands	862	812	158	362	7	2,527	208	713	19	294	10	5,972
Total, £	26,719	60,561	9,566	17,602	7,846	82,669	9,119	8,759	1,127	33,849	41,059	298,876

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	165	...	...	130	...	4,511	363	739	...	7,055	12,963
Germany	2,952	6,801	2,477	31,977	2,584	59,584	154	1,266	6,561	27,419	141,775
Holland	...	99	...	1,794	...	150	24	...	68	46	2,181
Belgium	353	855	205	78	20	1,768	...	276	629	15,812	19,996
France	362	28	736	1,366	981	471	36	1,450	2,492	828	8,750
Switzerland	119	359	...	112	120	1,444	...	...	...	135	2,289
Italy	15	891	...	9	...	...	...	...	...	1,388	2,303
Austria-Hungary	...	992	33	635	...	130	...	...	520	182	2,492
United States	2,071	601	221	501	43	10,677	4,919	88	1,081	131	20,333
Canada	9	...	...	...	...	...	...	...	15	120	144
Total, £	6,046	10,626	3,672	36,602	3,748	78,735	5,496	3,819	11,366	53,116	213,226

Additional imports: Spain, carbons, £90.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above	10,511	664	...	1,811	...	5,442	...	190	337	73	

TOTAL EXPORTS: £298,876. TOTAL RE-EXPORTS: £19,028. TOTAL IMPORTS: £213,316.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns Imports are credited to the country whence consigned, which is not necessarily the country of origin.

COAL COSTS.

By "INTERESTED."

Coal is an important factor in the working of an electricity supply station; it is at once the best friend and biggest enemy. Cost of fuel alone represents about one-third the total works costs, therefore too much care cannot be exercised in handling fuel. None will gainsay that an efficient means of keeping proper track of all coal delivered and consumed is essential. Such a system, whether comprised of books or cards, in order to be of any practical use, must give in a clear, concise form full details of quantities and qualities received and consumed, and, on the other hand, must be simple enough to enable one to obtain the desired information therefrom without unnecessary trouble and waste of time.

Coal Ordered (No. 1, left page).

Name of contractor.	Date of order and order No.	Name and class of fuel.	Total quantity.	Dates due for delivery and quantities.	Price per ton.

Coal Received (No. 1, right page).

Date.	Rail or seaborne. Truck Nos. or name of barges.	Names of coal.				Total weight of each order.	Average price per ton delivered.	Calorimeter tests. B.T.U.
		t c q	t c q	t c q	t c q			

When making arrangements for booking fuel, the points which should be borne in mind are as follows:—(*a*) The correct weight of coal actually delivered into the bunkers should be obtained, irrespective of whether payment is made on the railway companies' weights, the agents' certified meter, the works weighbridge, or by any other means, because it will be obvious to anyone that a true record of quantities consumed will very soon throw out the amount supposed to be in stock, if less coal is actually received than is booked inwards. The merits of various methods of purchasing coal need not enter into discussion here, as the value of any discrepancy between the quantity received and that actually paid for must be added in the cost by booking out at the average price per ton. This can easily be obtained by dividing the weight of each delivery into the figure actually paid for same. (*b*) A record should be made of the amount each stoker burns, and also the total used on each shift. This is necessary for the purpose of checking any waste in the way of bad stoking, and likewise an inferior delivery. A calorimeter test cannot always be relied upon to show a true value of the whole contents of a barge load, or even a train load, unless many samples are taken and tested. (*c*) Costs should be prepared at least once a week. I use the words "at least" here advisedly, because, in order to secure a strict hold on coal consumption and obtain the best results, weights should be compared with each other day by day. In actual practice a return showing costs, prepared once a week, is found to be sufficient information for the purpose of comparison, but with quantities used, a day by day return is required. By comparison of figures each day it is possible to make inquires into any apparent wastage at the time it occurs, and this enables such steps to be taken as may be deemed necessary for preventing a continuance of waste.

In the method of booking described and illustrated below, arrangement is made whereby quantities used are shown at the end of each shift, and the cost shown only once a week. Such a system as described, with but little alteration to suit particular requirements, is in use at present in a certain London works, and is reported to work exceedingly well. Four books are used as follows:—Coal Order Book, Job Order Book, Coal Book, and Record of Coal Tests. The patterns shown almost explain themselves, but for the sake of a little more lucid explanation here and there I will briefly run through them.

Coal Book (No. 3, left page).

Date.	Shift No.	Boilers on load.	Steaming coal.			Banking coal.			Totals. Cwt.	Remarks.
			Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.		
Sunday ...	1									
	2									
	3									
Monday ...	1									
	2									
	3									
Tuesday...	1									
	2									
	3									
Wednesday	1									
	2									
	3									
Thursday...	1									
	2									
	3									
Friday ...	1									
	2									
	3									
Saturday...	1									
	2									
	3									
Totals...										

No. 1, *Coal Order Book.*—Directly an order is placed for fuel, an entry is made in this book in the columns set apart for the desired information, and the deliveries are set out in a similar manner from time to time, in the respective columns for same. The last column it will be noticed is for the results of calorimeter tests. A glance at this book at any time will show just how much of each class of coal is on order, when due for delivery, and the price, &c.

No. 2, *Job Order Book.*—In some works it is not found advisable to ask shift men to make up time sheets, the hours worked being obtained from some form of time recorder. However, in this case, use is made of these books in which the men enter their time on one page and material on the other. Of course each stoker enters the quantity and quality of coal he uses day by day, making a note of that used for banking, if any. From these books the engineer-in-charge abstracts figures for making up the No. 3 Coal Book.

Job Order Book (No. 2, left page).

Dr.			Cr.		
Date.	Description of goods.	Quantity.	Date.	Description of goods.	Quantity.

Job Order Book (No. 2, right page).

W. O. No.				J. O. No.				Totals.
Date.	Description of work.	On.	Off.	On.	Off.	On.	Off.	

Engineer-in-charge .....

No. 3, *Coal Book.*—This is *the* book of the set, and, I think, shows all the desired information at one opening. It gives much useful and important information. The engineer on each shift enters up the fuel used on his particular shift, and by doing so is continually brought into touch with the coal consumption.

Coal Book (No. 3, right page).

Coal delivered :—	Tons.	Cwt.	Qrs.
Total			
Coal used from beginning of year to date ...			
Coal in stock at midnight.....day.....191...			

Coal Analysis.

Quality.	Brought forward. t. c. q.	Delivered. t. c. q.	Total. t. c. q.	Issued. t. c. q.	Carried forward. t. c. q.	Total. t. c. q.
Totals ...						

	Corresponding week last year.
Amount of coal used ... t. c. q.	Amount of coal used ... t. c. q.
Cost ... ... £ s. d.	Cost ... ... £ s. d.
Units generated at lb. per unit	Units generated at lb. per unit
Units metered at lb. per unit	Units metered at lb. per unit

No. 4, *Coal Test Book.*—Here we have a permanent record of calorimeter tests, which forms a useful reference when considering quotations for coal.

Coal Test Book (No. 4).

Date .....

Name of coal .....

Delivered by .....

Name of barge .....

Price at wharf ..... Class of coal .....

Details of Test.

Weight of coal .....

Temperature of water :

Time ..... Temperature .....

" ..... " .....

" ..... " .....

" ..... " .....

" ..... " .....

" ..... " .....

" ..... " .....

Total rise in temperature of water .....

Residue weight .....

Calorific value .....

THE HOMOPOLAR DYNAMO.

By E. KILBURN SCOTT, M.I.E.E., A.M.I.C.E.

Considering that Faraday exhibited the first homopolar dynamo at the Royal Society in 1831, and that many inventors since then, including the versatile Prof. G. Forbes, have studied the problem, it is a little strange that the homopolar machine has not been more successful.

Its simplicity as compared with the commutator machine constantly forces itself on the attention of all who study dynamo-electric machinery. Yet for years we have been content to make very bad alternators of many phases, and by means of complicated commutators and brush gear converted the alternations into direct current. As a matter of fact, the homopolar is the only true direct current machine, for it is the only one that gives a current without pulsations such as one obtains from a storage battery.

Until the advent of the steam turbine only comparatively low speed prime movers were available, and at low speeds the voltage of a homopolar is low. For a given power the current is also relatively high, and as the construction is such that the current has to be collected many times, this means special brushes. Many designs have failed because of this brush problem.

Some designs were also mechanically faulty, because of being made with disks like the original Faraday machine. This means *radial air gaps*, and they have always been a source of trouble in all dynamo machines.

A cylindrical core having an air gap parallel to the shaft was made by Rankin Kennedy to get over the end thrust difficulty, but even so the homopolar made little progress. The fact is, it was invented before its time, and only now, when large units of power running at high speeds are required, is the type really having what one might call "a square deal." It is essentially a machine for coupling to steam or gas turbines.

Many cases could be instanced where plant made and experimented with on a small scale has not shown to advantage, but in

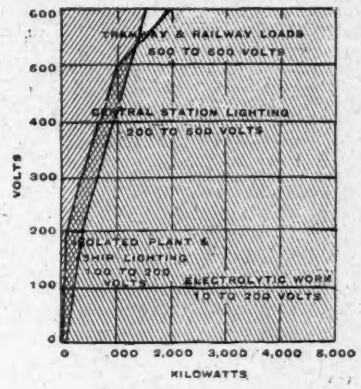


Fig. 1.

large sizes it has been all right. This is most distinctly the case with homopolar machines, for they have little scope in small sizes and at low speeds.

In the case of commutator machines, it is a widely known fact that for every voltage there is a limit of size, above which practicable machines cannot be built. On the other hand, it is also beginning to be recognised that for larger outputs the homopolar type has an almost unlimited field. This is well shown in fig. 1, where the left-hand section shows roughly the field for which commutator turbo-dynamos are suitable, and the right-hand section the field for which homopolar machines are best. Between the two there is a narrow debateable area, for which each may be used.

Unlike commutator machines, which are limited by permissible commutator speeds, homopolars are in every way suited for high speeds. Commutators not only give trouble by getting out of

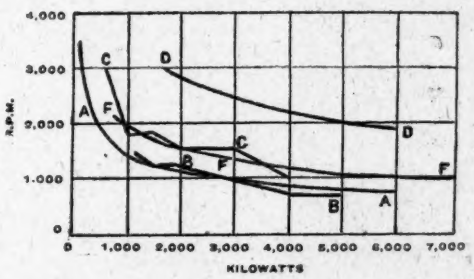


Fig. 2.

shape at high peripheral speeds, but above a certain output it is necessary to connect two dynamos in tandem to one steam turbine. This lowers the efficiency of the power unit, increases cost, and leads to vibration troubles by reason of the long thin shaft.

Homopolars, on the other hand, can be made of any size, and within the limits of tensile stress of steel, can run at practically any speed. The parts with least strength are the collector rings, and thanks to high grade steels now in use, they can be run at as high as 24,000 ft. per minute. As compared with commutator machines, the rotating part can be short and stiff; it is easily balanced, and what is more to the point, it stays in balance.

From every point of view, the faster a homopolar runs, and the larger its output, the better it works. The higher the speed the greater the efficiency, and the smaller the weight and cost per kilowatt. The most suitable speeds are the same as for steam turbines, so that the two are exactly suited to each other.

This is well shown by the curves in fig. 2. Curve A shows the speeds of a line of homopolars that have been designed by Mr. R. H. Barbour, a sample machine of which was exhibited at the Electrical Exhibition at Olympia. Curve B gives the lowest speeds of standard turbines by a well-known maker. Curve C shows the speed given by turbine builders, as those at which they prefer the machines to run. Curve D represents the absolute limit of speed beyond which it would be mechanically impossible to run homopolars. Curve F shows speeds of homopolars having a peripheral velocity of about 16,000 ft. per minute, that is to say, about 25 per cent. higher than Mr. Barbour's homopolar machine.

As curves C and F almost coincide, they prove that so far as speeds are concerned the steam turbine and homopolar machines are exactly suited to each other.

Fig. 3 is a view of the Barbour homopolar machine previously mentioned, and as it presents many novel features, a description will be of interest. The machine gives 50 KW., 100 volts, 500

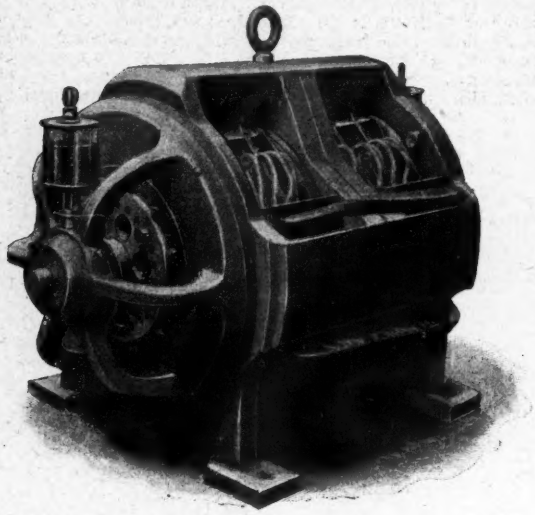


Fig. 3.—The Barbour Homopolar Dynamo.

amperes, when running at 3,500 revolutions per minute, and has the following dimensions :—

Total length between bearings	...	29½ in.
Height of frame	...	28¼ „
Width of frame	...	28 „
Diameter of rotor	...	14¼ „
Length axially of centre pole	...	6 „
Length of each end pole ...	...	3½ „
Width of each slip ring ...	...	½ „
Number of conductors ...	...	12
Field current	...	5 amperes
Peripheral velocity of rotor...	...	12,800 ft. per minute

Fig. 4 is a longitudinal section showing the poles, slip-rings and field coils, and fig. 5 is a cross-section showing the four yokes in section and two brushes pressing against a slip-ring.

The frame consists of three poles, A B and C, each extending without interruption or change of sign completely round the rotor. These are connected together by the four yokes D, E, F, G. The three castings are bolted together after the field coils, H, J (and two similar coils not seen), have been placed in position. It will be noticed that these field coils are placed close to the air-gaps, so that there is very little opportunity for magnetic leakage.

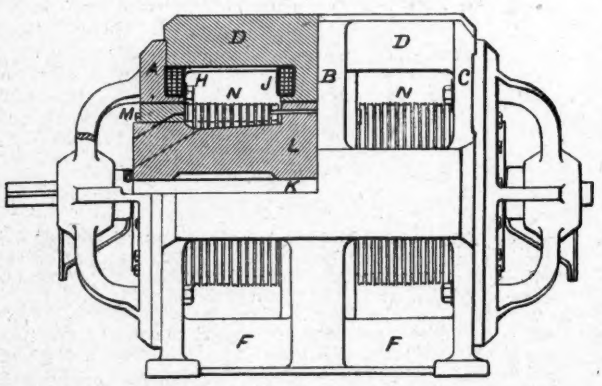


Fig. 4.

The rotor consists of a shaft K carried in bearings, which may be part of the end frames, as illustrated, or separate. A core L midway between the bearings is of the full rotor diameter, where it forms the centre pole under B, and has end rings which form the end poles. Only one of these end rings M is shown.

Between the centre and end poles are the slip-rings N N, 12 on each side. The slip-rings and end poles are firmly connected together by 12 through bolts P, which are insulated from the slip-rings by mica washers. In addition to the bolts there are 12 conductors Q which connect each pair of slip-rings together. When these conductors pass through slip-rings to which they have not to be connected, they are, of course, insulated therefrom by mica washers. There are also mica washers between adjacent rings to insulate the rings from each other. Between the washers, air can circulate freely.

The method of fastening the slip-rings to the rotor core is seen in fig. 6. This shows the through bolts in position and the holes in the slip-rings for 12 conductors. The six ventilating holes at the end of the core by which air is led underneath the slip-rings are clearly seen. As the voltage between adjacent rings is only about the same as between adjacent bars on a commutator, there is very little risk of flashing across. But even if an incipient arc did form, it would be immediately blown out by the draught of air.

The slip-rings are endless and of special steel, which can be safely worked up to 12 tons per sq. in. tensile stress. The rings have semicircular grooves, and these take the brushes R, R as shown in fig. 5. The brushes are held in position by the springs S, S, which can be adjusted.

The brush consists of a flexible stranded copper core wound with an armouring of German-silver wire. This armouring has been found by experience to make better contact and give more consistent results as to friction, &c., than any other metal. Under actual test, one of these brushes will collect 500 amperes without any undue heating from a ring 14 in. in diameter and only ½ in. wide.

Independently of mechanical reasons for German silver working well on steel rings, it has been thought that the remarkably good and consistent results obtained with this type of brush may be due to the current being evenly collected over the whole surface, each coil of wire armouring picking up its proportion of current and passing it into the central copper core. It is conceivable that a brush made of copper only would not only give trouble for mechanical reasons, but that on account of the low resistance of the copper the current would tend to bunch at that end of the brush to which the terminal leads are connected. Whatever the reasons, the fact remains that the armouring of resistance wire on a flexible copper core does collect very large currents from a slip-ring running at 12,000 ft. per minute without any trouble.

This particular construction of brush is an essential feature of the Barbour homopolar machine, and one of the difficulties overcome. Experimenters in the past have tried to get a large

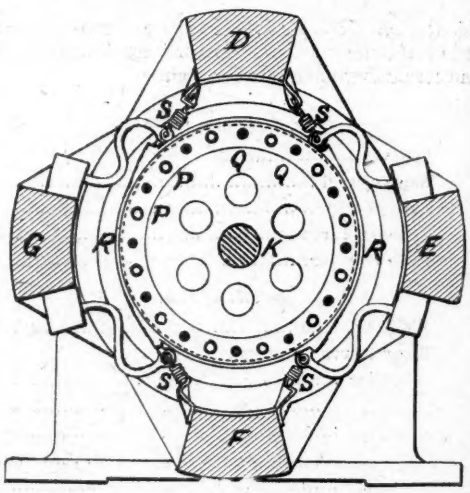


Fig. 5.

amperage per sq. in. of contact surface, the idea being that if only the brush was pressed down firmly enough large currents could be collected. What actually results, however, is an intense concentration of both frictional and electrical heating over a small surface, and naturally this brings about rapid disintegration. Of course, the point was that it would otherwise require an extremely large number of ordinary brushes to collect the requisite amperes.

In this connection it will be of interest to refer to the figures obtained by Messrs. Cottle and Rutherford in Vol. XLV of "The *Journal* of the Institution of Electrical Engineers." They tried four types of brushes :—(*a*) Hard carbon ; (*b*) hard metallic brush with some admixture of graphite ; (*c*) soft graphite brush with a trace of copper ; (*d*) pure carbon, moderately soft ; of these (*c*) alone gave results which are described as at all workable at high speeds.

In Table I the results obtained with this type at peripheral speeds of 1,850 ft. and 12,000 ft. per minute are tabulated ; also corresponding values for Mr. Barbour's special armoured brushes at the higher speeds are given. The first four columns contain figures taken from the paper, and the remaining four have been calculated from them. The term "frictional volts" is used because it is a convenient synonym for "watts lost in friction per ampere collected."

In this table the lowest value of "total loss—volts," *i.e.*, the sum of the "contact volts" and the "frictional volts" represents the most efficient value of brush pressure and current density. It will be noticed that the best figure obtained by Messrs. Cottle and Rutherford at 12,000 ft. per min. is 6·3 volts. Now, consider the "watts per square inch" ; under these most "efficient," conditions 1,260 watts are being turned into heat for each square inch of contact surface! It is this rather than the low efficiency which puts such brushes out of court. An excessive temperature must necessarily exist at the surface, with consequent softening of the material of the brush and rapid wear.

With the brushes used by Mr. Barbour, the frictional loss is practically independent of brush pressure and of speed, but varies directly with the contact surface. Beyond a certain very moderate figure, extra brush pressure has no effect on the contact volts,

The current density found by experience to be suitable is about 100 amperes per square inch, and a reference to the table below shows that the watts turned into heat per square inch of contact surface are 110 under these conditions (see last line of table). Also that the watts per square inch in the case of ordinary slow-speed carbon brushes at the usual density of 40 amperes per square inch are 116 (see 10th line of table).

It would almost appear that there is a general law that the watts per square inch of contact surface ought not to exceed 100 to 120. To attempt values of 1,000 watts inevitably leads to trouble.

Experimenter.	Peripheral speed.	Pounds pressure per sq. in.	Amps. per sq. in.	Voltage drop at contact.	Coefficient of friction.	Frictional. Watts.	Frictional. Volts.	Total loss, volts.	Watts per sq. in.
Cottle and Rutherford.	12,000 ft. per min.	8	40	3·5	0·5	1,090	27·2	31·7	1,230
			120	4·8	0·5	1,090	9·0	13·8	1,656
			200	5·1	0·5	1,090	5·2	10·3	2,060
		12	40	3·8	0·08	261	6·5	10·3	412
			120	5·0	0·08	261	2·2	7·2	864
			200	5·0	0·08	261	1·3	6·3	1,260
		16	40	1·5	0·2	875	21·9	23·4	936
			120	1·6	0·2	875	7·3	8·9	1,068
			200	2·3	0·2	875	4·37	6·7	1,340
Barbour.	1,850 ft. per min.	4	40	0·8	0·5	84	2·1	2·9	116
			120	1·0	0·5	84	0·7	1·7	204
			200	1·1	0·5	84	0·42	1·52	304
		8	40	0·65	0·3	100	2·5	3·15	126
			120	0·90	0·3	100	0·83	1·73	207
			200	1·10	0·3	100	0·50	1·6	320
		16	40	0·4	0·28	189	4·7	5·1	204
			120	0·6	0·28	189	1·55	2·15	258
			200	0·7	0·28	189	0·94	1·64	328
	12,000 ft. per min.	—	40	0·46	—	40	1·0	1·46	58·4
			60	0·54	—	40	0·67	1·21	72·6
			80	0·62	—	40	0·5	1·12	89·6
			100	0·7	—	40	0·4	1·1	110

It is sometimes stated that the homopolar is very heavy for its output, but, if properly designed, such is not the case. At any rate, for coupling up to large steam turbines, it can be shown that homopolars are no heavier than alternators or dynamos. Also it can be shown that the space occupied by a design on the lines of Mr. Barbour's is considerably less than for ordinary machines now on the market.

As to cost of manufacture, the drawings herewith show that there is no comparison; the homopolar can be made very much

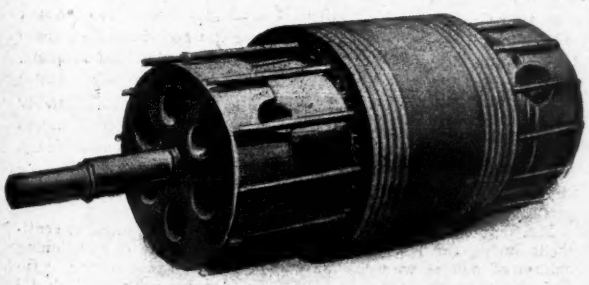


Fig. 6.—Rotor of Barbour Homopolar, showing slip-rings partly assembled, and all the through bolts in position.

cheaper. There is nothing in it except steel and a little copper and mica. Also all the parts are turned to gauge, so there is practically no fitting or hand work except on the brushes.

The laminated structure which is so essential in all other dynamo-electric machines is absent in the homopolar.

So far as the flux paths, &c., are concerned, the ordinary commutator and homopolar machines differ as follows: The flux in the air-gap of the former machine is bunched under the several poles, and it flows through the armature in a circumferential direction, also the air-gap has to be long for electrical reasons. With the homopolar, on the other hand, the flux under the poles does not vary, and when it reaches the rotor, it travels through it in an axial direction, also the air-gap can be short, being governed solely by mechanical considerations.

Armature reaction can be reduced in the same way as in ordinary dynamos by throttling the section of the cross magnetic path, and this is done for the centre pole of the Barbour machine.

For a given number of conductors and slip-rings, a number of varying voltages can be readily obtained; thus the Barbour machine will give 6,000 amperes at 8 volts just as easily as it gives 500 amperes at 100 volts; it simply means that for 8 volts all the slip-rings are connected in parallel, whereas for 100 volts they are in series and there is no difference whatever in the length or construction of the machine.

Now, compare this with an ordinary commutator dynamo; for 8 volts, 6,000 amperes, the commutator would be about five times as long as for 100 volts, 500 amperes, and to collect 6,000 amperes there would be an immense number of brushes. There is no comparison between the two types of machine from this point of view; the homopolar has the advantage in all ways.

One very interesting feature of the homopolar is the exceedingly easy way in which it can be compounded. All that is required is that the flexible connections from the brushes to the terminals shall be a little longer, and be carried round in the same direction as the current that is flowing in the field coils. Then the current in the brush leads adds on ampere-turns, and by merely turning the brush leads the other way the compounding can be made differential.

THE MUNICIPAL TRAMWAYS CONFERENCE.

Tramway Track: Methods of Construction and Maintenance.

Three reports by Messrs. James Grierson, Henry Mattinson and Robt. Holt, heads respectively of the permanent way departments of the Glasgow, Manchester and Leeds tramways, were submitted on the above subject, summarising information which had been obtained from a number of representative tramway systems. To those who are associated with permanent way construction, both the abstract of replies and the reports will be extremely valuable for references. On the subject of rails, Mr. Holt points out that the popularity of B.E. Standard rail sections is not due to any particular merit which they possess; they are purchased because they are stock standards, while Mr. Mattinson adds that their composition is by no means of a grade suitable for electric traction. As regards the use of lighter rails, Mr. Holt considers that these would be a mistake on suburban routes, as rail wear is more a question of speed than traffic density and speeds are highest on outlying routes.

Each report specially refers to the Sandberg silicon steel rail; the systems giving comparative records show a reduction in wear of between 33 per cent. and 40 per cent.

Some 30,000 tons of these rails have been supplied to English tramways, Leeds using upwards of 6,000 tons, on which, Mr. Holt mentions, corrugation markings do not develop as in the case of the ordinary steel, and up to the present, after four years of service, no corrugations have had to be ground from the Sandberg rails in Leeds.

The continued investigation of steel alloys with a view to obtaining a suitable composition for electric traction purposes is advocated.

On the question of joints, Mr. Grierson says the replies indicate that while a large majority use some form of fishplate, or fishplate and sole plate combined, only four systems claim to have a joint suitable for their traffic, and therefore some good form of plated joint is yet to be found. His experience is that all joints, depending on traffic, sooner or later develop dishing, and in the centre of Glasgow numerous Thermit-welded joints have broken; with plated joint remedial measures can be tried, the welded joints, however, require cutting out and a short piece of rail inserting and jointing up. It is only fair to state that the other reporters have had a wholly satisfactory experience with the Thermit-welded joint, Mr. Mattinson basing his opinion on 7,000 such joints at Manchester, which during five years have developed less than 3 per cent. of breakages, while Mr. Holt mentions that in Leeds 11,000 similar joints (60 miles of track) have been made during the past eight years, and a similar percentage of breakages is recorded for the whole trackage, though only ·7 per cent. on later works.

The cause of the ill success of this joint under heavy traffic at Glasgow is evidently worth careful investigation, in view of its success elsewhere under similar conditions; Mr. Holt points out the close relation between the rail steel and the welded joint, and Mr. Mattinson emphasises the skilful handling required to attain success.

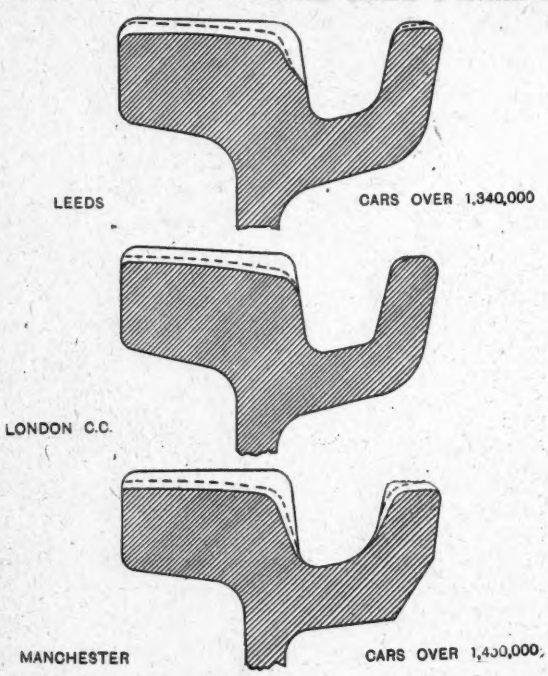
While all agree that the bonding of welded joints is not absolutely necessary, tests in Leeds show that the average conductivity of the Thermit-welded joint is 8·75 per cent. lower than the rail itself, and the addition of one bond greatly increases the conductivity.

There appears to be no general agreement as to anchoring; anchors are, of course, very often inserted, but in Manchester the standard construction has no anchors, and a trial length of two miles of anchored double track has necessitated more maintenance than the adjoining unanchored track under identical usage.

The majority of tramways use solid manganese steel points and crossings; in Glasgow the experience is in favour of cast-steel in conjunction with iron-bound crossings; in Manchester, Mr. Mattinson prefers the iron-bound crossing with manganese renewable plates, while in Leeds, renewable centre plates have been most unsatisfactory. It appears to be admitted that manganese steel castings are very liable to honey-combing.

All the reporters draw attention to the advantage of spiral curves, both in regard to easy riding of the cars and lessened wear and tear; it is noted, however, that 20 systems are laying plain, instead of spiral, curves.

Turning to the question of track laying, 42 systems lay the steel first and afterwards fill in the concrete; both Mr. Grierson and Mr. Mattinson lean towards a reversal of



Wear on Sandberg Rail shown by Dotted Line; Wear on Bessemer Rail, by Hatched Section.

Scale, half-size.

these operations, the latter instancing the difficulty of setting and packing the rails above ground and of handling the concrete round the rails and avoiding any disturbance of them. Mr. Holt, however, considers the favoured method to be by far the most satisfactory, adding that the rails are more readily levelled than the concrete, and the latter is not liable to disturbance by the handling of the rails. Tramway engineers must choose for themselves.

There appears to be a divergence of opinion as to rail packing, but none in regard to the necessity for efficiently draining the concrete bed, the neglect of which generally leads to the well-known "pumping" action of the rail and disturbance of the setts. Sleeper construction is referred to by Messrs. Grierson and Holt; the former has found pitch pine sleepers very satisfactory, while the latter is evidently not smitten with the transverse sleepers used in Leeds, partly on account of the extra initial cost.

In Glasgow, reconstruction work is carried out at night, as, owing to traffic density, single line working on a temporary track is considered impracticable; the cheapest method is by means of a temporary by-pass track with portable turnouts. The corrugation trouble is referred to; grinding out by means of abrasive blocks fitted into the slipper brakes, or by grinding machines, seems to be the only remedy, and must be taken in hand immediately the corrugations are noticed. Mr. Grierson refers to the greatly increased maintenance cost of track along which heavy commercial motor vehicles, traction engines, &c., pass, and notes that this seems to affect very few systems. Discussing the dishing of rails on the trailing side of the joints, Mr. Mattinson mentions, as a remedy which is coming to the front, welding into the dished rail a piece of hard steel, by means of the oxy-acetylene blow-pipe; the added steel is hammered during the process, a slight excess being fused in, the surface is then ground and filed even; the 100 joints done in Manchester give every promise of success.

Manchester also has in use a compact three-spindle drill operated by a flexible shaft for drilling three fish-bolt holes simultaneously; the machine slides along the rail and is automatically set.

For expeditious work the oxy-acetylene cutter may be used, but it results in a somewhat ragged hole; either it or the oxy-hydrogen cutter may replace the saw, but will not compare with the saw for quality of cut. Mr. Mattinson lays stress on the value of this class of apparatus for permanent way work where time is an object, and we can only conclude that in view of the proximity of an electric supply, the specialisation of motor-driven tools and electrical apparatus for similar purposes must have been sadly neglected.

While in all tramway construction work, local conditions play an important part, the divergences of practice disclosed by the reports and abstract of replies, are more than one would expect under the circumstances, or than can be accounted for, by differences in local traffic conditions.

It appears to be not so much a question of what is used, as of how it is used.

Tramcar Meters.

Discussion on the paper by Messrs. R. G. Cunliffe and J. G. Cunliffe, *printed in abstract in our issue of Oct. 13th, 1911.*

The discussion on this paper was opened by Mr. T. B. Goodyer, general manager, Croydon Corporation Tramways, who said that the cost of electrical energy was a serious item to a tramways undertaking, more especially where the energy was bought from an outside body, and tramway managers ought to be thankful for the co-operation of meter manufacturers in enabling reliable measurements of the energy to be obtained. Since the introduction of meters in Croydon, the saving had been about £5,000 per annum, and returns were showing a still further tendency to decreased consumption per car-mile. He favoured the use of meters because they tended to make the motorman operate the cars properly. They were the means of detecting faulty cars. By enabling faulty adjustment of the various parts of motor equipment to be readily discovered, the wear of armature bearings, brake shoes, &c., was reduced by percentages varying from 15 to 40. He considered it should be possible to obtain similar results on all systems.

The President remarked that if expenses were at bedrock at present you could not expect to obtain these large savings.

Mr. W. Clough, Bury Tramways, spoke of the change of sentiment during the last few years. To-day, instead of questioning the use of meters, we were out only to find the best meter. He thought that the type of meter used was a subject which did matter. There came a time in the continued use of equipments when they should be scrapped, and the information could only be obtained by a meter of absolute, as distinct from relative, accuracy. He entered into a detailed discussion of the relative advantages and disadvantages of the various forms of meters employed. The time meter extensively used on the Continent, with a possible accuracy of 10 per cent., was intended only to check "rushing" current, and allow coasting, and also to show any undue use of the power brakes. The time meter did not differentiate between series and parallel running, and although a new meter with two dials had been introduced, it was dearer and less simple in construction. To ensure absolute accuracy one could not use ampere-hour meters, as it was impracticable to assume a constant voltage; hence, he considered that the only accurate type was the watt-hour meter. Why should anyone be asked to accept anything else? They were formerly somewhat fragile, but certainly not now. He had had 50 in use for the last 18 months, with entire satisfaction, and his experience was in no way exceptional. Regarding the volt-hour meter developed by the authors, to obtain the average value of the voltage fluctuation, he thought that this would increase the error which already existed in the ampere-hour meter. He thought that the correct average voltage for each route would have to be obtained and corrections made to the ampere-hour readings accordingly; this the men would very likely object to. The "moral" effect of meters was in showing the man that he was spending money when using current; the "immoral" effect, if he might so call it, was the danger of motormen not stopping for passengers, in rushing down grades and running through loops. The watt-hour meter had traced wasteful cars as well as wasteful motormen, and the result was a great reduction in repairs. With regard to large systems, he thought they might be divided up into districts, and so be worked with as much saving as smaller systems.

Mr. Pilcher, Aberdeen, stated that he had got good results in his district, but he thought too much elaboration was a great danger. He did not take intermediate readings of the meters, but simple readings which applied to groups of drivers. During the last three years he had saved about 13 per cent. in running expenses.

Mr. Baker, Birmingham, said there was no scepticism now regarding the use of meters; they were considered a necessary part of the equipment. Last year he had installed 300 meters, showing a saving of £5,000 during the last nine months. Besides a decreased current consumption, he had also found a very great saving in brake-shoes and in repairs generally; the meter also increased the efficiency of the motorman, who would not accept an inefficient car. The possible disadvantage was an increased liability to accidents through jerky starting and stopping, and rushing hills. He found that the best men did not object to meters.

Mr. Hamilton, Leeds, prefaced his remarks by stating that he was not particularly favourable to the use of meters, especially where the tramway authority produced the current. The primary business of a tramway system was to attract passengers and to convey them as cheaply as possible to their destination. If one cheapened the cost of doing so by losing passengers, this was an entirely wrong method. If the motorman did not use current how could he get his car along? and in the endeavour to save current the advantage was to build up quickly, thus causing a jerky start and a tendency to accidents. If the motorman was to save brakes he must shut off his current and "coast" to his stopping place; he must coast down hill at a rapid rate in order to get sufficient momentum to carry him along the level and up the next hill, and this also constituted a danger.

Mr. Spencer, Bradford, said that his system was one of the first to use meters, and he had found them giving full satisfaction. Of course, quite apart from the question of meters, there are many other considerations affecting a comparison of drivers, and he found that long periods were necessary, even as long as 12 months, in order to obtain really satisfactory comparisons. At first he had found differences of as much as 30 per cent. between various drivers, but now the difference between highest and lowest on some routes averaged about 5 per cent. or 7 per cent.

Mr. Ellis, Cardiff, said that although the running cost may be very low, still the use of meters would affect many economies; although his department generated current and sold it to the Electric Lighting Committee at total inclusive cost of 7d. per unit, they still considered it advisable to equip the cars with meters. They had 130 meters in use, and the returns showed an enormous saving in repairs and current consumption. He stated in contradiction to Mr. Hamilton that the use of meters stopped sudden starting and sudden stopping of cars.

Mr. R. G. Cunliffe, in replying, said that Messrs. Goodyear and Clough had expressed themselves as being in disagreement with the statement that savings cannot be made on the larger undertakings equal to those made by them on their smaller systems. This was, nevertheless, the fact, and was due to the following reasons:—

(*a*) *Equipments.*—In the larger systems, owing to division into separate departments each controlled by an expert specialist and with well-equipped works and testing departments, the equipments are maintained in a better condition than on a smaller system and the margin for saving is not so wide. Thus, in Manchester, relatively smaller savings can be effected in this direction.

(*b*) *Driving.*—There is far greater congestion on the large than on the small system. As was shown in the paper, congestion greatly limits the saving effected in driving, as the driver is controlled by circumstances which he cannot alter, and has not got the free hand necessary for obtaining the best results. This was illustrated by the figures given in the paper.

Mr. Goodyer asked if there were no congestion in Berlin and Vienna. The President disagreed.

Mr. Cunliffe said they did not wish to be understood to recommend the sole use of absolute values. Such values were not required for routine purposes, as relative values were sufficient for placing men and cars in their proper order. Correction for absolute values did not change the order but merely changed each result by a constant percentage throughout the list. In their practice they used absolute values for the determination of transmission losses and for comparisons between different types of car and between different routes. In each case where this was done, large numbers of results were taken and the correction applied to them in bulk and not separately, and the corrected figures did not come before the men. The error of the volt-hour meter, small though it was, was allowed for in making the correction, and did not enter into the corrected results. This error was definitely known from the calibration of the instrument. Experiments conducted on Mr. Clough's system had borne out the experience that numerous instances are available of cars being equipped with both ampere-hour and watt-hour meters in series, where both meters have given almost identical results with varying voltages, although the ampere-hour meter has been known to be working accurately. In Bury a car run for 50,000 miles showed less than 1 per cent. difference between the two meters. The paper mentioned not the fragility, but the greater fragility of the watt-hour meter as compared with the ampere-hour meter. It was a matter of comparison in which the ampere-hour meter had indisputably the advantage. It was of interest to note that the prediction of a decrease in the maximum demand had been realised at Bury. The splitting up of large systems recommended was essential to success, but this applied equally to all systems. Elaborate methods should be avoided. It should be, of course, understood that they did not recommend parallel running where there was not sufficient space available for advantage to be taken of this method of driving. It was largely a matter affected by local conditions.

THE ELECTRICAL CONGRESS AT TURIN.

(*Continued from page* 640.)

Sig. Guido Semenza's paper in Section II on the "Simultaneous Working of Several Central Stations, Feeding a Single Network," raised several interesting points. The author discussed the two alternatives, viz., that forming the system described by the title, and the sub-division of the network into independent sections, each with its own station. Parallel working, he considered, though good in theory, presented many difficulties in practice. An alternative adopted by the Edison Co., of Milan, was to have each feeder fed from several stations, with automatic cut-outs on each source, so that, in case of a failure at any station, the extra load was distributed over those remaining. This paper led to a good discussion, the general tenor of which was, however, decidedly in favour of standard parallel working.

A short but interesting communication was made to this Section by Sig. Elvio Soleri on the limits up to which cables can be employed for the transmission of energy. The general conclusions are that the possibilities of cable transmission are not exhausted by actual practice. Besides the price and the insulation question, that of surges is naturally very important and received full attention at this Congress. In this connection, Herr Leon Lichtenstein's paper on some experiments made on high-tension cables at the laboratory of the Siemens-Schuckert Co., at Nonnendamm (Berlin), is very instructive. The experiments described are chiefly in the direction of limiting losses by skin-effect and hysteresis, but there is at the end a note on the 60,000-volt feeders of the Bitterfeld-Dessau line, laid on the solid system by Messrs. Siemens-Schuckert. The Felten & Guilleaume Co. afterwards added a similar cable. These cables have been working six months for 10 hours per day without interruption. The author does not state what precautions are taken against the setting up of oscillations on this system. The frequency on these feeders, it is to be noted, is low, being only 15 cycles per second.

Herr W. Weicher's paper, "High-Tension Discharges in Relation to Shed and Hanging Insulators on High-Voltage Transmission Lines," is admirably illustrated with photos showing the effects which it is desired to guard against. A protective device is advocated, consisting of a metallic shade extending umbrella-wise from the top of the porcelain insulator. Arcs or discharges taking place from the line pass from one shade to the other, without causing damage to the insulator, and the shades also form an additional protection against rain. It is evident that these shades will be useful in the case of momentary discharges, but there is at least a question whether they would not be likely to encourage arcing. This system is especially advocated for suspended insulators.

Section III.

On September 15th, Sig. Campos presented to the Congress his paper on "The Propagation of High-tension Oscillations." After some remarks on "skin effect" and electromagnetic radiation, the author explained a method of artificially augmenting the loss of energy and the dissipation of high-frequency oscillations, by increasing the effective values of resistance and conductance. He instanced as remedial measures that of covering the line with a thin layer of high-resistance material, the use of self-inductance transformers with a secondary shorted through a resistance, or with the secondary shunted, or led through condensers in series with such a resistance. He pointed out the advantages which would result from a study of the phenomena produced, even on a reduced scale. This was one of the most practical papers on this subject, and was very well received. The question whether phenomena on extra-high-tension lines can be reproduced on a smaller scale is, of course, open to discussion, but, in conjunction with experience gathered on such lines in operation, the experiment could not but be helpful.

Section IV.

Lighting and Heating.—Proceedings in this Section opened on September 11th with M. Rossander's paper on "The Present Condition and Future Development of Electric Heating." This paper describes the construction of

various kinds of radiators and heaters, notably the "Thermophiles" of M. Herrgott, in the form of carpets or cloths having conductors running through them, presumably at a very low voltage, a form of radiator very little known in this country.

The cost of cooking by electricity is given at ·4 to ·5 KW.-hours per kilogramme of meat (Goisot), although, as the author remarks, other authorities vary considerably in their records. The above would be from ·2 to ·6 of a penny per pound, according as the price of the unit was 1d. or 3d. Herr Ritter gives figures of cooking effected at as low as ·1 KW.-hour per pound (beef), at which rate it would become a commercial possibility. Comparing electricity with gas, the author reckons that electricity, to compete in heating effect, should not cost more than ·415 of a cubic metre of gas, a comparison which would hardly work out in favour of the former except in localities where gas is 7s. 6d. per 1,000 ft. This comparison, however, is based on the heating of water. The actual price of electricity for cooking purposes the author estimates at ·7d. to 1·4d. An experiment has been tried by the Hartford Electric Light Co., of the United States, in which apparatus for cooking, made by the company, estimated to be capable of doing all the cooking for 3-5 people, are furnished with energy for a fixed charge of $3 (12s. 6d.) per month. This rate allows the supply, at the worst, a receipt of ·3d. per KW.-hour, even if the apparatus is in use 24 hours per day. An example is given of a house warmed by electricity (that of Dr. Ekstrom, near Stockholm) at no greater expense than the use of ordinary central heating, the energy in this case costing ½d. per KW.-hour. This system would, however, have skilled and constant superintendence in the instance given. It is a careful and comprehensive paper.

Mr. Leon Gaster (editor of the *Illuminating Engineer*, London, and delegate of the Illuminating Engineering Society of London) read his paper "The International Outlook in Scientific Illumination," on September 15th. He dwelt upon the necessity which exists for study of the problem of illumination, in all countries, a matter which is hardly receiving sufficient attention, although several Committees interested therein exist. These Committees are occupied either in the study of photometrical questions, or specialise on certain systems of illumination by gas or electricity. He then went into the work done by the Illuminating Engineering Society of London, and touched upon standardisation of units, so that not only should candle-power mean the same in various countries, but that it should show whether horizontal, spherical, mean hemispherical, or other intensity was indicated. He also noted the need for information on the question of measuring illumination. Tables of proposed symbols, put forward at different Congresses, are given at the end of the paper, and definitions of terms used in describing illumination. Mr. Gaster subsequently put forward a resolution requesting the "Illuminating Engineering Society" of London to form an International Commission on this subject, which resolution was carried unanimously, and constitutes the principal one emanating from Section IV as a result of this Congress.

Section V.

Proceedings in this Section opened on September 12th with M. G. Calzolari's paper on "Monophase and Three-phase Traction on Heavy-traffic Lines." The author, after treating the history of his subject, and examining, from existing examples, the characteristics of the two systems, both technical and economical, inclines in favour of three-phase traction, premising that electrification of railways will in future be confined to lines where it is necessary to increase the carrying capacity, steam proving uneconomical on account of slopes and long tunnels. The paper concludes with a description of the three-phase installation on the Genoa-Milan and Genoa-Turin lines, showing what heavy goods traffic may be dealt with by electric traction; with three 60-ton locomotives, a train weight of 550 tons (metric) can be hauled, or with a single locomotive 190 tons. This was a practical paper, clearly expressed as to commercial possibilities. It provoked an animated discussion.

Mr. L. Hoest read, on September 13th, his paper on the various methods of conveying the current to the collector on the car, by overhead wires, third rail, conductors in slots, &c., and the double catenary suspension of the L.B. & S.C. line. The author notes the overhead wire as the only method applicable to alternating currents.

Dr. Kummer's paper on the "Development of Motor-Vehicles for Electric Traction on Single-Phase Lines," was read, in his absence, by Mr. Barnet-Lyon. This paper is largely a study of the relation between the weight of the locomotive or vehicle and the tractive effort of the motors which it carries.

Sig. A. Bezzi's paper on the "Application of Electricity to Submarines" provoked a good discussion. Tables of comparative output for weight are given for various cells. With the increase in size of the submarine, the size of the battery becomes considerable. The 1,000-ton *Mariotte* of the French Navy has a battery of capacity 1,950 KW.-hours. The weight of a battery of 1,000 KW.-hours, with Planté plates, is given at 75·5 tons; pasted, 62 tons; iron-nickel, 42 tons; and iron-nickel (Jungner), 43 tons. The number of discharges on these batteries is given as 250, 200 and 400 for the last two; the first figures appear very low. The Edison and Jungner accumulators are mentioned as not yet tried in batteries of such large capacity. A comparison of the various systems of motor-control is also given.

Sig. G. Gyaros's paper "Notes on Electric Traction with High-Tension Continuous Current," was read on September 15th. The author notes the first railways on this system, that from Köln to Bonn, and the Indianapolis-Louisville Line (1907). He also records the economy effected on the Washington, Baltimore and Annapolis line by the substitution of continuous for single-phase traction. He instances five Hungarian lines, varying from 10 to 35 miles in length, which are being equipped for this system by Messrs. Ganz. The highest pressure to be employed on these lines, for the overhead wire, is 1,500 volts. The author estimates that if the pressure could be raised to 2,500 or 3,000 volts, the continuous current would be in a position to compare favourably, for this purpose, with alternating current at 15,000 volts.

Section VI.

Dr. Jewett's "Long-Distance Telephony" was, in his absence, read by the secretary on September 11th. This is an explanation of the system employed on, and the organisation of, a leading telephone line in the U.S.A. The principal characteristics are those of the Bell system.

Major W. A. J. O'Meara, who was acting as president on this day, resigning the chair to Dr. Di Pirro, read his paper on the "Different Systems of Multiple Telegraphy." This is a clear and comprehensive *résumé* of the characteristics of the various systems, and their advantages from the point of view of rapid transmission of the message. It concludes with a description of the diminished current Morse quadruplex system, and the augmented current quadruplex, or "increment" system.

On September 12th Dr. Valdemar Poulsen's "Wireless Telephony" was, in the absence of the author, read by the secretary. After describing the arrangement of circuit and receivers employed, the author estimates that it is possible to establish a satisfactory service over a distance of from 60 to 120 miles, and gives instances of sending messages over distances of 162 and 330 miles (Esbjerg, and Los Angeles, San Francisco). On this paper the President (Major O'Meara) remarked that there is every prospect of a largely increased use of wireless telegraphy in the future. M. Milon anticipated that the ships in a navy would ultimately communicate with one another in this manner, also small islands with the mainland.

M. H. Milon then read his paper "Automatic and Semi-Automatic Telephone Systems." This briefly describes the main features of the two systems, showing generally an economy in working in favour of the automatic. It is a very clear *résumé* of what must necessarily, in practice, appear intricate to non-experts, and encouraging to patience with present appliances, in hope of better things.

Prof. P. O. Pedersen's paper was read by the secretary on September 15th. It is an investigation into the possibilities of secrecy in wireless telegraphy. This depends principally on the use of codes, although communication may be made more difficult of interception by high-speed working. High speed would, however, appear to increase the possibility of errors.

Dr. J. Erskine-Murray's paper on the "Efficiency of a

Wireless Telegraph Apparatus" is a brief paper intended to act as a guide to those who study this question, both from the aspect of number of words transmitted and of consumption of energy. The principal factors which enter into the case are noted. This was read by the secretary.

Signor Bellini brought the meeting to a close with his description of the "Azimutal Hertzien Compas"—an instrument designed to show the position of a vessel by means of impulses transmitted to it from the shore, *i.e.*, a modification of wireless telegraphy.

(*To be continued.*)

ITALIAN ELECTRICAL UNDERTAKINGS.

The Turin Exhibition, and more particularly the holding of the International Congress of Applied Electricity in that town has again drawn attention to the development of the electrical industry in Italy. The report of the Chief Inspector of Industry and Commerce to the Minister of Agriculture and Commerce, containing statistical details of 63 tramway undertakings, notices of 2,000 installations described as "central works for the distribution of electrical energy," and similar particulars of a number of military supply works, was available to the delegates and others attending the Congress.

For purposes of consideration, the tramway systems may be divided into those having routes over 40 miles long, those having lines under 2 miles, and those of medium length. Of the first class, the largest is the Cuneo-Peveragno system, having 34 km. of double line and 56 of single (20 and 33 miles). The number of cars is 112. From the small proportion of motors to trailers, it would appear that this line is run as a railway with trains of vehicles having one locomotive or motor carriage. No details of generating plant are given in this instance.

The next in importance of length is the line between Antignano and Montenero, of the Livorno Tramways Co., having 64 km. of double and 13 of single line (total 46 miles run). This line has three 240-KW. Schuckert generators, and a 720-A.H. battery of accumulators. The number of motor-cars is 30, and 16 are classified as "reserve." The proportion of these reserves is apparently high on all these lines, and probably includes those under repair. The motors in this instance (two per car) are only 8 H.P. The maximum gradient is only 7·5 per cent. Another important line is that of the Milan city tramways, totalling 45 miles of single track. This is worked by the Edison Italian Electrical Co. It has five 500-KW. dynamos and two of 1,000-KW., and accumulators with the large capacity of 7,460 A.H. The number of motor-cars is 393 with 125 in reserve, including apparently a large number of special cars. There are also 204 trailers. The motors (two per car) are 37 and 25 H.P. The steepest gradient is only 3 per cent.

Milan also has four suburban lines of from 2½ to 9 miles, all running on 550-volt D.C., and fed by the same company. Rome is served by four companies, the Societa Tramvie e ferrovie Elettriche being the most important. This has 24 miles of single-track line, with an 850-KW. dynamo and a 1,400 ampere-hour accumulator. The large proportion of accumulators in these installations is due probably to the use of water-power, which is the prime mover in this case. The cars are again classified with very large reserve; 13 motors and two trailers to 91 motors and 13 trailers in reserve. The motors are of 60 and 25 H.P. The Societa Romana tramways-omnibus has 2 miles of single and 1½ of double track, with an equipment of 130 cars running and 38 in reserve, with two trailers. The maximum gradient is 6·7 per cent., but on the funicular portion it is 47·7 per cent.

The line to Civita-castellana (Rome) has 32 miles of single track, and six motors and three trailers on ordinary service, with 11 and 16 respectively in reserve. The maximum gradient is 7 per cent. The motors are of 40 and 35 H.P., two and four of the former, and four of the latter being employed per car. This is a monophase system at 6,500 volts, 25 periods outside the town, and 550 volts in the town.

Turin has four sections, the town tramways (Societa Elettricita Alta Italiana and Tramvie Municipali), covering 3 miles double and 9 single, and 3 miles double and 2 miles single respectively. These have between them 145 motors in ordinary service and 35 in reserve, and 13 trailers. The motors are of 19 to 30 H.P., and the steepest gradiant is 17·5 per cent.

The Chivasso line has 21½ miles of single track, the Moncalieri 16, including 4½ double. These have 20 and 13 cars respectively, with 27 and 22-H.P. motors, and no steep gradient. Ventimiglia has a line worked by an English company, the Riviera Electric Supply Co., and there are several French and Belgian companies. It is noticeable that Rome, Milan and Turin, all have overhead wire systems of distribution. An interesting line is that of Vesuvius, run at 570 to 750 volts by a 66-KW. gas-driven generator, the number of motor-cars being three, with two (25 and 50-H.P.) motors per car. The gradients are 8 per cent. for ordinary traction and 25 per cent. where a rack is employed. The length is 4 miles, and the car-miles run per day 54. The equipment is Vignoles, and distribution overhead. Other mountain lines are at Capri and S. Pellegrino.

The large distributing concerns which supply power for all purposes are exceptionally well situated in this country owing to available water-power. One of the largest is the Societa Anonima Elettricita Alta Italia, which had a steam generating station in Turin of 500 H.P. to start with, and now has a capacity of 25,000 H.P. from one hydraulic and two steam stations. It supplies principally Turin and neighbourhood.

The Societa Riviera di Ponente, in Liguria, has two hydro-electric stations (one near Ventimiglia, and one near Taggia), and a steam station at Savona, together capable of 22,000 H.P. The Italian Edison Society has at present 35,000 H.P., but is putting in a hydro-electric plant which will increase its capacity by 24,000 H.P. This company serves Milan and suburbs.

The Societa per Imprese Elettriche Conti has six generating stations, five of which are on the Ticino, and one on the Brembo, the total capacity being about 45,000 H.P. It also possesses a station of 12,000 H.P. at Magenta, and another hydro-electric station of 20,000 H.P. is in construction at Verampio (Lombardy).

The Municipality of Rome has under construction a station with Diesel engines of a capacity of 8,000 H.P., and a scheme for a hydro-electric plant at Castelmadama of 11,000 H.P.

At Naples, the Societa Generale per l'Illuminazione is constructing a steam station of 10,000 H.P., and another large hydraulic station is to be opened on the Volturno, which will furnish 12,000 H.P.

A variety of details are given in this report of military installations, but these are of comparatively small output. Amongst the commercial undertakings mentioned are the Societa Italiana for the manufacture of carbide of calcium, acetylene and other gas, disposing of 50,000 H.P. of electricity from hydraulic stations, of which the greater part is already available. The voltage on the transmission line to Rome will be 86,500. The length of this line is 74 km.

A similar company, called Societa Piemontese, in Valle d'Aosta, also manufactures ferro-silicate and silica.

A comparative table of cost of electricity for power or lighting is given. From this it would appear that lighting varies from 4d. to 10d., with an average of about 8d., and power 1d. to 4d., with an average of 2½d.

BREAKDOWNS OF MACHINERY IN 1910.

Mr. Michael Longridge's report to the British Engine, Boiler and Electrical Insurance Co., Ltd., for the year 1910 shows a notable recovery in the rate of increase in the insurance of steam, gas and oil engines as compared with the previous year. The proportion of gas engines to steam engines insured continues to increase, being now 25 : 20, and the size and power of the former are growing. The rates of breakdown among insured steam and gas engines were 1 in 9·7 and 1 in 10·8 respectively. Taking the steam engine breakdowns, valves and valve gear accounted for 26·6 per cent., spur gearing for 8·9, air-pump motions for 10·3, air-pump buckets and valves for 8·0, columns and bedplates for 7·5, main shafts for 5·8, and pistons, &c., for 5·3 per cent. of the breakdowns. In the case of gas and oil engines, valves and valve gear were responsible for no fewer than 42·8 per cent., connecting rods for 9·1, cylinders for 8·5, main shafts for 7·9, pistons for 5·1. All other items were under 5 per cent., except gas-producers, which caused 8·5 per cent. of the stoppages. While the valve-gear breakages show a great increase (29·6 in 1909), the breakages of cylinders have been almost halved (15·4 in 1909) and main shafts show a considerable reduction—both very important items.

Turning to electrical machinery, generator breakdowns numbered 1 in 16·5 D.C., 1 in 5·3 A.C.; motors 1 in 8 D.C., 1 in 12 A.C.; starters and controllers, 1 in 25·4. Of the generators insured, 94·5 per cent. were D.C., and of the motors, 83·5 per cent. D.C.; the proportion of A.C. machines insured is, however, steadily increasing, having risen from 3 per cent. in 1901 and 1902 to 14·5 in 1910. Armatures and rotors bulk most largely in the breakdowns, the proportion being 43 per cent. in the case of generators and 33 per cent. in the case of motors; next come commutators and slip rings, 25 and 26 per cent.; magnet coils and stator windings, 13 and 17; and rotating parts not carrying current, 13 and 9 per cent. Brush gear and terminals accounted for only 2 and 5 per cent. respectively, while stationary parts not carrying current caused 4 and 10 per cent. of the breakdowns. There is a distinct tendency for the proportion of armature and rotor breakdowns to diminish in proportion to the rest.

In starters and controllers 57 per cent. of the failures occurred in connection with the resistance coils, 12 in the contacts and switch arms, and 18 in the automatic apparatus, the rest being due to parts not carrying current. A closer analysis of the failures of motors, which form the large majority of the machines insured, shows that D.C. armatures and A.C. rotors are about equal in proportion of accidents (33 and 30 per cent.), a rather unexpected feature—in previous years the rotors have made a much better showing. Commutators, however, which are taken out separatively, show 29 per cent. as compared with slip rings 5 per cent. The stationary windings of D.C. motors, again caused only 15 per cent., as against A.C. windings 36 per cent. of the failures—and the latter figure is a great improvement over previous years. The stationary parts of A.C. motors also show up badly with 22 per cent., compared with 9 per cent. Dirt and neglect, age and deterioration, and bad work or design are the three heads under which fall most of the breakdowns of generators and motors.

Commenting on typical cases, Mr. Longridge suggests that it is unwise to use white metal in self-lubricated bearings; if the bearing heats and the metal melts, the rotor strikes the stator. Ball-bearings are preferable, and the company has found them seldom give trouble. The disastrous effect of saturating the windings with oil, through carelessness or otherwise, is pointed out; the insulation becomes charred and ruined.

Many breakdowns are due to carelessness in details—the lack of insulating bushes where cables to slip-rings are led through the shaft; failure to cover sharp edges in contact with, or proximity to, armature and rotor windings (especially at the ends of the slots); neglect to secure all conductors on rotating parts against vibration or relative motion; and the use of "dry" joints inside motor casings, instead of proper couplings or terminals.

A curious case was met with where one of a large number of shunt-wound motors was used for driving a large lathe, with a face-plate, 10 ft. in diameter, for turning heavy castings; the motor started and ran well, but sometimes, in the act of switching off, the main fuses blew. It was found that the starter had, in addition to the starting resistance, a regulating resistance in the shunt circuit, with which the speed of the motor could be increased 15 per cent. If the motor was running at top speed, with a heavy job in the lathe, and the starting lever was moved back, the excitation was increased while the machine was driven by the lathe considerably above the normal speed, so that the motor acted as a generator and returned current to the line of sufficient strength to blow the fuses. Had the attendant used the main switch instead of the starting switch to stop the motor, the trouble would not have happened. In addition, this use of the starter interrupted the shunt circuit at full excitation, thus straining the insulation of the field magnet winding.

The peculiar loss of insulation of electrical machinery in suction gas-driven installations receives notice. Breakdowns have occurred in such cases, due to the accumulation of a black, greasy deposit at the back of the commutator. This deposit, in one case, was found to consist of copper dust, 70 per cent.; mineral oil, 19 per cent.; vegetable oil, 11 per cent.; and traces of sulphur, sulphuric acid, &c. All the bare copper in the engine and dynamo room has been observed to assume a dark chocolate colour, wherever this trouble has been experienced—apparently due to the gas fumes, and it is suggested that the copper dust, which causes the breakdowns, is the result of attempts to clean the blackened commutator by rubbing it with emery or glass paper, whilst in motion. This seems to provide a possible explanation of the connection between producer gas and the copper dust, but fails to explain the origin of the oily matter which causes the dust to adhere to the surfaces with which it comes into contact, and Mr. Longridge points out that the problem requires further investigation.

As regards the insurance of boilers, economisers, &c., the net increase in the number insured was only 1 per cent. The diminishing rate of increase is ascribed to the reduction in the number of boilers in the country, due to economy in the use of steam, the replacement of small steam engines by gas engines and electric motors, and the increased evaporative power of the boilers used, as well as to the fact that most of the boilers in use are already insured, and the number of insuring companies has increased. A number of the usual horrible examples of corroded boilers are cited.

In an appendix to the Report, an account is given of a test of a 1,000-KW. turbo-generator, used for driving a spinning mill and weaving shed, formerly driven by ropes and shafting. The turbine was of the Zoelly type, running at 3,000 R.P.M., and driving a three-phase alternator of 1,250 KW. at 50 cycles. A surface condenser was used, with Edwards air-pumps and a Rees-Roturbo circulating pump, driven by a 35-H.P. motor. There were eight 210-B.H.P. motors with wound rotors and slip-rings, and three of 40 B.H.P.

The steam consumption (at 151—157 lb. per sq. in., superheated 184—224° F.) as the average of two tests, was found to be 15·9 lb. per KW.-hour, or 11·85 lb. per E.H.P.-hour. The author shows from other data that the turbine was more economical than any but exceptionally economical mill engines, and probably as economical as the best. He gives additional information showing that, after taking into account all losses in transmission, "there is little to choose between a turbine with a motor drive and an engine with a rope drive for loads of about 1,500 H.P."; but he points out that other considerations enter, such as upkeep, space and first cost. While not pursuing the matter to a definite conclusion, Mr. Longridge gives data which should prove useful to anyone who wishes to work it out for himself.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

22,156. "Electrical cooking appliances." B. Thomas and E. Thomas. October 9th.

22,232. "Electrically-driven cash-counting receipting and registering till." Mrs. H. Godefroid née Hamspohn. (Convention date, October 10th, 1910, Germany.) October 9th. (Complete.)

22,235. "Repairing of metallic-filament incandescent electric lamps." Allgemeine Chemisches Laboratorium Oskar H. Arendt. (Convention date, October 8th, 1910, Germany). October 9th. (Complete.)

22,238. "Electric signalling apparatus for telephones and the like." G. H. Nash and Western Electric Co., Ltd. October 9th.

22,254. "Making steam by electricity for all marine steam boilers and other steam boilers." G. S. Holme. October 10th.

22,274. "Accident-preventing or life-saving apparatus for electric tramcars and like vehicles." T. A. Bennett. October 10th.

22,276. "Combination locks for electrical lamps and like electrical fixtures." G. Barker. (Midland Electrical and Manufacturing Co., United States.) October 10th. (Complete.)

22,280. "Mounting or supporting dynamos and electric motors." W. A. Thier. October 10th.

22,281. "Electric batteries or accumulators." J. H. May and Electrical Power Storage Co. Ltd. October 10th.

22,282. "Electrical lamps, more especially intended for use in mines." J. H. May and Electrical Power Storage Co., Ltd. October 10th.

22,315. "Electric heating apparatus." J. F. Monnot. (Convention date, October 14th, 1910, France.) October 10th. (Complete.)

22,350. "Enclosed electric fuses." British Electric Co., U.S. October 10th.

22,356. "Loud-speaking telephonic apparatus." E. A. Graham. October 10th. (Complete.)

22,372. "Means of enclosing electrical apparatus." A. H. Curtis and Adams Manufacturing Co., Ltd. October 11th.

22,397. "Construction of jack strips for telephone switchboards or the like." Siemens Bros. & Co., Ltd., and E. A. Petithory. October 11th. (Complete.)

22,403. "Telescoping masts for aerial transmitting or receiving electro-magnetic influences." Soc. d'Electricite Mors. (Convention date, October 13th, 1910, France.) October 11th. (Complete.)

22,414. "Electric light fitting." E. Ryan. October 11th.

22,426. "Portable electric signal lamps." A. J. Stevens and A. J. Lyon. October 11th.

22,427. "Telephone receivers." E. J. Loosmore. October 11th.

22,429. "Electric searchlights." L. Pasqualini. October 11th.

22,435. "Means for electrically transmitting and receiving messages." W. F. C. Michaelis. October 11th.

22,436. "Telegraphic apparatus." F. G. Creed and W. A. Coulson. October 11th.

22,441. "Method of using electric batteries for supplying lamps." Chemische Fabrik Greisheim-Elektron. (Addition to 15,447/11. Convention date, May 24th, 1911, Germany.) October 11th. (Complete.)

22,443. "Signals for use in wireless telegraphy." O. Angelini. October 11th. (Complete.)

22,495. "Apparatus for generating heat by means of electric currents." H. A. Kent. October 12th. (Complete.)

22,500. "Terminal clips, wire attachments and the like." Rex Motor Manufacturing Co., Ltd., and H. Sarginson. October 12th.

22,547. "Electric switches." H. F. Bigge and F. R. Butt. October 12th. (Complete.)

22,548. "Electric arc lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 12th.

22,550. "Metallic sheathings or covers for electric conductors." L. Sunderland. October 12th.

22,558. "Telephonic apparatus." E. A. Graham. October 12th.

22,582. "Telephonic transmitters, receivers, and other like diaphragm instruments." A. Marr. October 13th.

22,624. "Distribution of electrical energy." P. V. Hunter and W. L. Shand. October 13th.

22,634. "Telephonic apparatus." E. A. Graham. October 13th. (Complete.)

22,635. "Manufacture of filaments or threads from viscous liquids or solutions." H. J. Ping and F. W. Schubert. October 13th. (Complete.)

22,653. "Means for causing magneto-electric sparking machines to spark, used in connection with internal-combustion engines when at rest." J. A. Husbands. October 14th.

22,656. "Electrical measuring instruments having movable coils. J. W. Record. October 14th.

22,660. "Appliance for obtaining static electricity from either positive or negative pole of the secondary of an induction coil." G. G. Blake. October 14th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Electric Switches. R. V. Venner and R. C. Griesbach. 17,658. July 25th.

Regulating or Controlling of Valves or the like by Electromagnetic Means. T. G. Rorke and E. Rorke. 22,397. September 27th.

Manufacture of Incandescent Electric Lamps. "Z" Electric Lamp Mfg. Co. and F. Hoge. 23,332. October 8th.

Electromagnetic Relays. Siemens Bros. & Co. and L. D. M. G. Ferreira. 24,008. October 17th.

Electric Lamps and Reflectors for the same. D. J. L. O'Brien and R. M. Catts. 25,401. November 1st.

Intercommunication Telephone Systems. Sterling Telephone and Electric Co. and G. Burney. 26,854. November 18th.

Electric Conversion. S. Cabot. 27,696. November 28th. (December 4th, 1909.)

Fixing in Position of Shades for Metal-Filament Lamps, and the Locking or Fixing of the Lamps in their Holders. W. G. Polack. 28,133. December 3rd.

Process for the Production of Iron by Electro-Deposition. S. Cowper-Coles. 28,236. December 5th.

1911.

Electrical Purification of Gases and Apparatus therefor. J. Y. Johnson. (Badische Anilin and Soda Fabrik.) 142. January 3rd.

Electric Arc Lamps. British Thomson-Houston Co. (General Electric Co.) 607. January 9th.

Relay for Undulatory Currents. R. von Leiben, E. Reisz and S. Strauss. 1,482. January 19th.

Portable Electric Transformer Apparatus for Supplying Current for Medical Purposes. D. Ranschburg and D. Perlusz. 1,951. January 25th.

Flat-iron Sales.—The American *Electrical Review* recently stated that according to estimates no fewer than 250,000 electric flat-irons were sold in the United States and Canada last year. "There are more than 10,000,000 homes within central station territory, of which fewer than 2,000,000 have electric service; consequently the estimated sales last year approximate one iron to every eight homes."